



05-6F-113 Records

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113.0607  
prevent. maint.

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September 29, 2003

Ms. Lynda L. Dorr  
Secretary to the Commission  
Public Service Commission of Wisconsin  
610 N. Whitney Way, P.O. Box 7854  
Madison, WI 53707-7854

Dear Ms. Dorr:

**American Transmission Company  
Preventative Maintenance Plan  
Wis. Admin. Code § PSC 113.0607**



In compliance with Wis. Admin. Code § PSC 113.0607(2)(b)6, American Transmission Company is submitting Preventative Maintenance Plan.

The plan includes a number of reports which outline the nature of the equipment involved, the number inspections performed and a percentage completion. Summary-level information is being provided to reduce this submittal. Detailed inspection and maintenance information will be provided upon request.

If there are any questions concerning this notification, please contact me at 262-506-6845 or via email at [sparker@atcllc.com](mailto:sparker@atcllc.com).

Very truly yours,

Stephen Parker  
Manager, State Regulatory Affairs

Enclosure

cc: Scot Cullen - PSCW

MFC  
Elev



# **PREVENTIVE MAINTENANCE PLAN**

**September 2003**



# ATC Preventive Maintenance Plan

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# ATC Preventive Maintenance Plan

## 1.0 Introduction

The American Transmission Company (ATC) took ownership and began operating the transmission assets contributed by Edison Sault Electric, Wisconsin Public Service, Wisconsin Electric Power, Wisconsin Power and Light, South Beloit Electric and Gas, and Madison Gas and Electric on January 1, 2001. In June 2001, Upper Peninsula Power Company, Cloverland Electrical Coop, Adams Columbia Electric Coop, Manitowoc Municipal, Menasha Municipal, Rock County Electrical Coop, Sun Prairie Municipal, Algoma Municipal, Central Wisconsin Electrical Coop, Kaukauna Municipal, Sturgeon Bay Municipal, and Sheboygan Falls Municipal contributed assets. The basis for determining which assets were transmission was the order issued in PSCW Docket No. 05-EI-119.

Wisconsin Act 9 was the genesis for the ATC. As part of ACT 9, each of the contributing utilities was required to provide operation and maintenance services to the ATC for a period of three years. In compliance with this provision of ACT 9, the ATC has signed an Operations and Maintenance (O&M) Agreement with each of the contributing utilities. This contract includes an annual Facilities Plan, which forms the basis of the ATC maintenance program. The annual Facilities Plan is a "rolling" 12-month agreement that is revised and extended quarterly, providing a mechanism to plan financial and labor resources. ATC is presently negotiating new O&M Agreements with the contributors to continue this relationship.

The ATC Maintenance and Inspection Staff is responsible for the maintenance of the ATC transmission system through this contracted relationship with the contributors. This staff monitors the progress of the contributing utilities in the execution of the work plan, provides guidance and direction to the utility contractors and works with the utility contractors on quarterly revisions to the plan. The staff consists of Transmission Line Maintenance Specialists and Substation Maintenance Specialists and Support Engineers who are located in Kingsford, Michigan, and DePere, Pewaukee, and Cottage Grove, Wisconsin.

The ATC Maintenance Staff has developed a uniform maintenance program for application to all ATC facilities and will be deploying an ATC computerized maintenance management system for use by contractors and local distribution companies who perform maintenance and inspections for ATC. For the years 2001 and 2002, the legacy maintenance plans of the contributors, as filed in the June 2001 PSCW 133 filing, were used with some migration towards the ATC program where possible.

The computerized maintenance management system will allow the ATC staff to prioritize expenditures across the entire ATC, manage work more closely, minimize the work to generate reports and better manage costs. The deployment of this system, Cascade, is scheduled as follows;

## ATC Preventive Maintenance Plan

Fall 2003	Wisconsin Public Service
Fall 2003	Madison Gas and Electric
Spring 2004	Wisconsin Power and Light
Summer/Fall 2004	We Energies
Fall/Winter 2004	UPPCo, Edison Sault, Cloverland (Michigan)

Cascade will not be deployed to the Municipal and Cooperative contributors. It was determined not to be cost effective given the limited assets contributed. These assets will be in the Cascade system but the ATC maintenance staff will perform data management/input.

For the years 2001 and 2002, the legacy maintenance plans of the contributors, as filed in the June 2001 PSCW 113 filing, were used with some migration towards the ATC program where possible.

## 2.0 2001 – 2002 Progress Report

### 2.1 Transmission Line Inspection Schedule and Completion Summary

The ATC owns, operates and maintains 69 kV, 115 kV, 138 kV, 161 kV, 230 kV and 345 kV overhead line facilities as well as 69 kV and 138kV underground transmission facilities.

Legacy Overhead Transmission Line Inspection				
	WPS	WE	WPL	MGE
Aerial - Circuit - Forestry	Bi Annual Annual	Bi annual As Needed	Annual Annual	Bi Annual N/A
Ground Patrol	1-4 years	1-4 years	10 year	Annual
Infrared	N/A	10 year	GOABs at SS	N/A
Wood Pole Inspection	10 year	10 year	12 year	10 year
Forestry	5 year	5-7 year	5 year	5 ½ year
Climbing inspection	As needed	As needed	As needed	As needed

- Aerial patrols of ATC transmission lines are performed at the intervals indicated above using a helicopter as a means of conveyance. Routine patrols are scheduled spring and fall. Emergency patrols following automatic operation of line protective relaying are performed on an as-needed basis.
- Ground patrols are performed using several means of conveyance based upon the topology of the right of way. Pick-up truck, all terrain vehicles and snowmobiles are all used. Frequency of inspections may be increased in specific areas where structure damage due to woodpeckers is common.
- Infrared inspections of line switches in the vicinity of substations, is typically performed along with the substation infrared inspection.

## ATC Preventive Maintenance Plan

- Wood pole ground line inspections are performed by a contracted service, which reports back an assessment of the pole condition. Treatments are done with the inspections. Poles are added to the inspection list after reaching a certain age, typically 20-25 years. These reports are reviewed by ATC Maintenance Specialists who issue repair instructions to the contracting utility.
- Climbing inspections are still utilized on an as needed basis in response to known hardware or structural problems.

Legacy Underground Transmission Line Inspection				
	WPS	WE	WPL	MGE
Ground Patrol	N/A	Monthly	N/A	Weekly
Manhole Inspection	N/A	5 year	N/A	N/A
Cathodic Protection-Rectifier Operation	N/A	Monthly	N/A	Bi Weekly
Anode Testing	N/A	2 year	N/A	Semi Annual

- The ATC underground transmission assets include both solid dielectric and high pressure fluid filled cable systems. Given the congestion of underground facilities in the urban areas, frequent patrol of the these lines is necessary to monitor excavations and other activities which may result in damage to the cable system.
- Periodic manhole inspections are necessary to monitor the structural condition of the manhole, inspect splices and verify coatings applied for cathodic protection are intact.
- Rectifier operation is verified.
- Anode testing is performed to verify the condition of sacrificial anodes.

# ATC Preventive Maintenance Plan

	Miles of Transmission Lines Contributed by Voltage						
	69 kV	115 kV	138 kV	161 kV	230 kV	345 kV	Total
Adams-Columbia Electric Cooperative	53.75						53.75
Algoma Utilities	1.50						1.50
Alliant Energy - Wisconsin Power & Light	1,908.02	0.05	777.11	2.70		107.39	2,795.27
Central Wisconsin Electric Cooperative	7.92						7.92
Cloverland Electric Cooperative	118.49		46.00				164.49
Edison Sault Electric	332.65		65.26				397.91
Kaukauna Utilities			8.77				8.77
Madison Gas & Electric	75.52		99.26			124.28	299.06
Manitowoc Public Utilities	14.22						14.22
Menasha Utilities			15.80				15.80
Rock County Electric Cooperative	2.20						2.20
Sheboygan Falls Utilities	3.86						3.86
Sturgeon Bay Utilities	7.92						7.92
Sun Prairie Utilities	15.84						15.84
Upper Peninsula Power Company	386.88		372.60				759.48
Wisconsin Electric	377.40		1,696.85		87.70	745.85	2,907.80
Wisconsin Public Service	511.52	475.06	345.19			123.80	1,455.57
Total	3,817.69	475.11	3,426.84	2.70	87.70	1,101.32	8,911.36

Regional Office Responsible for Maintenance			
Depere	Cottage Grove	Pewaukee	Kingsford
	53.75		
1.5			
	2795.27		
7.92			
			164.49
			397.91
8.77			
	299.06		
14.22			
15.8			
	2.2		
3.86			
7.92			
	15.84		
			759.48
		2907.8	
1,455.57			
<b>1515.56</b>	<b>3166.12</b>	<b>2907.8</b>	<b>1321.88</b>

# ATC Preventive Maintenance Plan

Overhead Transmission Line Inspection (Alliant East, Madison Gas & Electric, Adams-Columbia Electric Cooperative, Rock County Electric Cooperative, & Sun Prairie Utilities) Total Circuit Miles = 3,166.12, T-Line Maint. Specialist - Jim Riggio

Aerial Circuit Patrol (Legacy; Alliant - Annual, MGE - Bi-Annual)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Planned (100%)	% of Plan Maintenance Completed
2001 Aerial Circuit Patrol (1)	3094.33	Alliant & MGE	2001	3,094.33	100.00%
2001 Aerial Circuit Patrol (2)	299.06	MGE	2001	299.06	100.00%
2002 Aerial Circuit Patrol (1)	3094.33	Alliant & MGE	2002	3,094.33	100.00%
2002 Aerial Circuit Patrol (2)	2795.27	Alliant	2002	299.06	934.69%
Aerial Forestry Patrol (Legacy; Alliant - Annual, MGE - N/A)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Per Plan (100%)	% of Plan Maintenance Completed
2001 Aerial Forestry Patrol (Summer)	3094.33	Alliant	2001	2,795.27	110.70%
2002 Aerial Forestry Patrol (Summer)	3094.33	Alliant	2002	2,795.27	110.70%
Ground Patrol (Legacy: Alliant - 10 year, MGE - Annual)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Per Plan (25%)	% of Plan Maintenance Completed
2001 Ground Patrol	110.95	Local LDC	2001	650.38	17.06%
2002 Ground Patrol	853.3 (Alliant)	Local LDC	2002	650.38	131.20%
Forestry Maintenance (Legacy; Alliant 5 yr cycle, MGE 5.5 yr cycle)	Circuit Miles Completed	Contractor	Date Completed	Circuit Miles Per Plan (20%)	% of Plan Maintenance Completed
Total 2001 R/W Forestry Maintenance	759.62	Asplundh, Hooper	2001	633.22	119.96%
Total 2002 R/W Forestry Maintenance	103 (MGE)	Asplundh, Hooper	2002	633.22	16.27%



# ATC Preventive Maintenance Plan

Wood Pole Groundline Treatment/Inspection (Legacy;Alliant - 12 year, MGE - 10 year)	# of Wood Poles (Total= approx. 47,492)	Contractor	Total Poles Per Plan (10%)	% of Plan Maintenance Completed
2001 Groundline Treatment/Inspection	5458 (Alliant), (ACEC)	Osmose	4,100	133.12%
2002 Groundline Treatment/Inspection	4025 (Alliant)	Osmose	4,100	98.17%
Climbing Inspection (Leagcy;as needed)	# of Structures Inspected	Contractor	Total Poles Per Plan (As Needed)	% of Plan Maintenance Completed
2001 Climbing Inspection	0	N/A	Not Applicable	Not Applicable
2002 Climbing Inspection	MGE-19 (Blount - Ruskin)	Hooper	Not Applicable	Not Applicable
Detailed Aerial Inspection (USA AirMobile)	# of Structures Inspected	Contractor	# of Structures Planned (N/A)	% of Plan Maintenance Completed
2001 Detailed Aerial Inspection	509	USA AirMobile	0	Not Applicable
2002 Detailed Aerial Inspection	2533	USA AirMobile	0	Not Applicable
Steel Pole/Tower Painting	# of Poles/Towers Painted	Contractor	Total Poles/Towers Per Plan (As Needed)	% of Plan Maintenance Completed
2001 Steel Pole/Tower Painting	38 (Alliant), 20 (MGE)	Rogers Paint Company	0	Not Applicable
2002 Steel Pole/Tower Painting	20 (Alliant), 34 (MGE)	Rogers Paint Company	0	Not Applicable
Infrared Inspection (Leagcy;Alliant - 3 yr cycle)	Switches Inspected	Contractor	# of GOABS Planned (33.33%)	% of Plan Maintenance Completed
2001 Infrared Inspection	204	Alliant	187	109.09%
2002 Infrared Inspection	208	Alliant	187	111.23%

# ATC Preventive Maintenance Plan

Overhead Transmission Line Inspection (Upper Peninsula Power Company, Edison Sault Electric, & Cloverland Electric Cooperative)  
Total Circuit Miles = 1,321.88, T-Line Maint. Specialist - Matt Westrich

Aerial Circuit Patrol (Legacy; Bi-Annual) Note: Michigan - N/A	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Planned (100%)	% of Plan Maintenance Completed
2001 Aerial Circuit Patrol (1)	763.00	Local LDC's	2001	763.00	100.00%
2001 Aerial Circuit Patrol (2)	763.00	Local LDC's	2001	763.00	100.00%
2002 Aerial Circuit Patrol (1)	763.00	Local LDC's	2002	763.00	100.00%
2002 Aerial Circuit Patrol (2)	763.00	Local LDC's	2002	763.00	100.00%
Aerial Forestry Patrol (Legacy; Annual) Note: Michigan - N/A	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Planned (100%)	% of Plan Maintenance Completed
2001 Aerial Forestry Patrol (Summer)	0	N/A	N/A	0.00	N/A
2002 Aerial Forestry Patrol (Summer)	763.00	N/A	2002	763.00	100.00%
Ground Patrol (Legacy; 1-4 Years) Note: Michigan - N/A	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Planned (25%)	% of Plan Maintenance Completed
2001 Ground Patrol	1,325.40	Local LDC's	2001	725.00	182.81%
2002 Ground Patrol	1,325.40	Local LDC's	2002	725.00	182.81%
Forestry Maintenance (Legacy; 5-7 year cycle) Note: Michigan - N/A	Circuit Miles Completed	Contractor	Date Completed	Circuit Miles Per Plan (20%)	% of Plan Maintenance Completed
Total 2001 R/W Forestry Maintenance	233.00	Great Heights/Northern Tree Co	2001	265.00	87.92%
Total 2002 R/W Forestry Maintenance	266.00	Asplundh/Northern Tree Co	2002	265.00	100.38%



# ATC Preventive Maintenance Plan

Wood Pole Groundline Treatment/Inspection 10 year cycle) Note: Michigan - N/A	# of Wood Poles (Total= approx. 17,450)	Contractor	Date Completed	Total Poles Per Plan (10%)	% of Plan Maintenance Completed
2001 Groundline Treatment/Inspection	2,100	Osmose	2001	1,745.00	120.34%
2002 Groundline Treatment/Inspection	3,800	Osmose/AES	2002	1,745.00	217.77%
Climbing Inspection (as needed) Note: Michigan - N/A	# of Structures Inspected	Contractor	Date Completed	Total Poles Per Plan (As Needed)	% of Plan Maintenance Completed
2001 Climbing Inspection	0	N/A	2001	Not Applicable	Not Applicable
2002 Climbing Inspection	0	N/A	2002	Not Applicable	Not Applicable
Detailed Aerial Inspection (USA AirMobile)	# of Structures Inspected	Contractor	Date Completed	# of Structures Planned (N/A)	% of Plan Maintenance Completed
2001 Detailed Aerial Inspection	0	N/A	2001	0	Not Applicable
2002 Detailed Aerial Inspection	0	N/A	2002	0	Not Applicable
Steel Pole/Tower Painting	# of Poles/Towers Painted	Contractor	Date Completed	Total Poles/Towers Per Plan (As Needed)	% of Plan Maintenance Completed
2001 Steel Pole/Tower Painting	0	N/A	2001	0	Not Applicable
2002 Steel Pole/Tower Painting	0	N/A	2002	0	Not Applicable
Infrared Inspection	Circuit Miles Inspected	Contractor	Date Completed	Circuit Miles Planned (N/A)	% of Plan Maintenance Completed
2001 Infrared Inspection	0	N/A	2001	0	Not Applicable
2002 Infrared Inspection	0	N/A	2002	0	Not Applicable

# ATC Preventive Maintenance Plan

Overhead Transmission Line Inspection (We Energies) - Total Circuit Miles = 2,907.80, T-Line Maint. Specialist - Chris Dailey

Aerial Circuit Patrol (Legacy; Bi-Annual)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Planned (100%)	% of Plan Maintenance Completed
2001 Aerial Circuit Patrol (1)	2,907.80	We-Energies	2001	2,907.80	100.00%
2001 Aerial Circuit Patrol (2)	2,907.80	We-Energies	2001	2,907.80	100.00%
2002 Aerial Circuit Patrol (1)	2,907.80	We-Energies	2002	2,907.80	100.00%
2002 Aerial Circuit Patrol (2)	2,907.80	We-Energies	2002	2,907.80	100.00%
Aerial Forestry Patrol (as needed)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Per Plan (25%)	% of Plan Maintenance Completed
2001 Aerial Forestry Patrol (Summer)	0	N/A	N/A	0.00	N/A
2002 Aerial Forestry Patrol (Summer)	750	We-Energies	2002	726.95	103.17%
Ground Patrol (Legacy; 1-4 year cycle)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Per Plan (25%)	% of Plan Maintenance Completed
2001 Ground Patrol	708	We-Energies	2001	726.95	97.39%
2002 Ground Patrol	768	We-Energies	2002	726.95	105.65%
Forestry Maintenance (Legacy; 5-7 year cycle)	Circuit Miles Completed	Contractor	Date Completed	Circuit Miles Per Plan (20%)	% of Plan Maintenance Completed
Total 2001 R/W Forestry Maintenance	420	We-Energies	2001	581.56	72.22%
Total 2002 R/W Forestry Maintenance	405	We-Energies	2002	581.56	69.64%

# ATC Preventive Maintenance Plan

Wood Pole Groundline Treatment/Inspection (Legacy; 10 year cycle after 20yrs old)	# of Wood Poles (Total= approx. 25,000)	Contractor	Date Completed	Total Poles Per Plan (10%)	% of Plan Maintenance Completed
2001 Groundline Treatment/Inspection	3,415	Osmose	2001	2,500	136.60%
2002 Groundline Treatment/Inspection	2,562	Osmose	2002	2,500	102.48%
Climbing Inspection (Legacy; as needed)	# of Structures Inspected	Contractor	Date Completed	Total Poles Per Plan (As Needed)	% of Plan Maintenance Completed
2001 Climbing Inspection	22	MJ Electric	06/24/05	Not Applicable	Not Applicable
2002 Climbing Inspection	0	N/A	N/A	Not Applicable	Not Applicable
Detailed Aerial Inspection (USA AirMobile)	# of Structures Inspected	Contractor	Date Completed	# of Structures Planned (N/A)	% of Plan Maintenance Completed
2001 Detailed Aerial Inspection	5,215	USA AirMobile	2001	0	Not Applicable
2002 Detailed Aerial Inspection	2,368	USA AirMobile	2002	0	Not Applicable
Steel Pole/Tower Painting	# of Poles/Towers Painted	Contractor	Date Completed	Total Poles/Towers Per Plan (As Needed)	% of Plan Maintenance Completed
2001 Steel Pole/Tower Painting	216	Camco	2001	216	100%
2002 Steel Pole/Tower Painting	149	Camco	2002	149	100%
Infrared Inspection	Circuit Miles Inspected	Contractor	Date Completed	Circuit Miles Planned (N/A)	% of Plan Maintenance Completed
2001 Infrared Inspection	0	N/A	N/A	0	Not Applicable
2002 Infrared Inspection	0	N/A	N/A	0	Not Applicable



# ATC Preventive Maintenance Plan

Overhead Transmission Line Inspection (Wisconsin Public Service, Algoma Utilities, Central Wisconsin Electric Cooperative, Kaukauna Utilities, Manitowoc Public Utilities, Menasha Utilities, Sturgeon Bay Utilities, Sun Prairie Utilities, & Sheboygan Falls Utilities) - Total Circuit Miles = 1,515.56, T-Line Maint. Specialist - Jerry Rhode

Aerial Circuit Patrol (WPS - Bi-Annual)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Planned (100%)	% of Plan Maintenance Completed
2001 Aerial Circuit Patrol (Spring)	1479.21	Local LDC	2001	1455.57	101.62%
2001 Aerial Circuit Patrol (Fall)	1479.21	Local LDC	2001	1455.57	101.62%
2002 Aerial Circuit Patrol (Spring)	1479.21	Local LDC	2002	1455.57	101.62%
2002 Aerial Circuit Patrol (Fall)	1479.21	Local LDC	2002	1455.57	101.62%
Aerial Forestry Patrol (WPS - Annual)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Per Plan (100%)	% of Plan Maintenance Completed
2001 Aerial Forestry Patrol (Summer)	1479.21	Local LDC	2001	1455.57	101.62%
2002 Aerial Forestry Patrol (Summer)	1479.21	Local LDC	2002	1455.57	101.62%
Ground Patrol (WPS - 1-4 Year, Coops & Muni's - Annual)	Circuit Miles Patrolled	Patrolled By	Date Completed	Circuit Miles Per Plan (25%)	% of Plan Maintenance Completed
2001 Ground Patrol	129.69	Local LDC	2001	378.89	34.23%
2002 Ground Patrol	615.99	Local LDC	2002	378.89	162.58%
Forestry Maintenance (5 year cycle)	Circuit Miles Completed	Contractor	Date Completed	Circuit Miles Per Plan (20%)	% of Plan Maintenance Completed
Total 2001 R/W Forestry Maintenance	362.58	Asplundh	2001	303.11	119.62%
Total 2002 R/W Forestry Maintenance	265.44	Asplundh	2002	303.11	87.57%

# ATC Preventive Maintenance Plan

Wood Pole Groundline Treatment/Inspection (Leagcy; 10 year cycle)	# of Wood Poles (Total=approx. 21,236)	Contractor	Date Completed	Total Poles Per Plan (10%)	% of Plan Maintenance Completed
2001 Groundline Treatment/Inspection	539	Local LDC	2001	2,124	25.38%
2002 Groundline Treatment/Inspection	3490	Local LDC	2002	2,124	164.31%
Climbing Inspection (as needed)	# of poles Inspected	Contractor	Date Completed	Total Poles Per Plan (As Needed)	% of Plan Maintenance Completed
2001 Climbing Inspection	0	N/A	N/A	Not Applicable	Not Applicable
2002 Climbing Inspection	423	WPS	04/30/02	Not Applicable	Not Applicable
Detailed Aerial Inspection (US AirMobile)	# of Structures Inspected	Contractor	Date Completed	# of Structures Planned (N/A)	% of Plan Maintenance Completed
2001 Detailed Aerial Inspection	0	N/A	N/A	0	Not Applicable
2002 Detailed Aerial Inspection	877	USA Airmobile Inc	2/30/02	0	Not Applicable
Steel Pole/Tower Painting	# of Poles/Towers Painted	Contractor	Date Completed	Total Poles/Towers Per Plan (As Needed)	% of Plan Maintenance Completed
2001 Steel Pole/Tower Painting	11	Rogers Painting	2001	11	100%
2002 Steel Pole/Tower Painting	2	Utility Service & Maintenance Inc	09/30/02	2	100%
Infrared Inspection	Circuit Miles Inspected	Contractor	Date Completed	Circuit Miles Planned (N/A)	% of Plan Maintenance Completed
2001 Infrared Inspection	0	N/A	N/A	0	Not Applicable
2002 Infrared Inspection	0	N/A	N/A	0	Not Applicable

# ATC Preventive Maintenance Plan

## 2.2 Transmission Substation Inspection Schedule and Completion Summary

The ATC has 94 ATC Only substations and 296 joint substations. The order in PSCW Docket No. 05-EI-119 prescribed that, at joint sites, the utility with the most investment at a site be owner of the common facilities. The common facilities are those assets which benefit all site occupants. The "predominant utility" is the owner of the common facilities. The ATC is the predominant utility at 65 of the joint sites and is therefore responsible for the maintenance of the common equipment. At 231 joint sites, the local distribution company is the predominant tenant. Cost of maintaining the common equipment are shared on a pro rata basis based upon relative investment.

Substation Inspections				
	WPS	WE	WPL	MGE
Substation Inspection	Monthly	Monthly	Bimonthly	Biweekly
Infra Red Inspection	6 month	Annual	Annual	Annual
Safety Equipment	Annual	Annual	Bimonthly	Annual

- Substation inspections are performed as indicated in the schedule above. Through the energy management systems, many components of the substation are monitored continuously. The intent of the substation inspection is to verify the security of the site perimeter and detect any developing equipment deficiencies and correct them before operational impacts occur. Patrol of a station's perimeter may be performed from a vehicle or on foot. The equipment inspections are performed on foot.
- Infrared inspections are performed to detect deficiencies in disconnect switches, conductors, connections, circuit breakers, power transformers, instrument transformers, etc. These inspections are performed from grade either on foot or from a vehicle.
- Safety equipment inspections are required by OSHA to ensure the integrity of ground jumpers and other site safety equipment.

A significant percentage of the overall maintenance budget is expended performing Preventive maintenance tasks. The tasks and frequencies for these activities is listed below.

Substation Preventive Maintenance	WPS	WE	WPL	MGE
Battery Maintenance - Terminal Cleaning	Annual	Annual	Annual	Annual
Battery Maintenance - Specific Gravity Measurements	Annual	N/A	Annual	Annual
Battery Maintenance - Impedance Testing	Annual	Annual	N/A	N/A
Battery Maintenance - Load Testing	N/A	N/A	5 year	N/A
Battery Maintenance - Check Electrolyte Levels	Monthly	Monthly	Bimonthly	Biweekly
Battery Replacements	20 year	20 Year	As Req.	As Req.
Circuit Breaker Compressor Checks	Annual	Annual	Bimonthly	Biweekly
Circuit Breaker Mechanism Pre Charge	As needed	Annual	6 Years	5 Years
Circuit Switcher Major Inspection	5 or 10 year	4 or 8 year	As Req.	N/A

## ATC Preventive Maintenance Plan

Gas Breaker - % SF6	6 year	As Req.	N/A	Biweekly
Gas Breaker - Moisture SF6	6 year	As Req.	N/A	N/A
Gas Breaker Diagnostics	6 year	6 year	6 year	Biweekly
Gas Breaker Major Inspection	12 year	As Req.	6 year	5 Years
Gas Breaker Mechanism Lube and Inspect	6 year	6 year	6 year	5 Years
Oil Breaker Diagnostics	12 year	4 year	6 year	Biweekly
Oil Breaker Dielectric	N/A	2 year	Annual	Annual
Oil Breaker Major Inspection	6 year	As Req.	6 Years	5 Years
Oil Breaker Mechanism Lube and Inspect	12 year	4 year	6 Years	5 years
Substation - Weatherize for Summer	Annual	Annual	Annual	Annual
Substation - Weatherize for Winter	Annual	Annual	Annual	Annual
Substation HVAC - Inspect Filter	Annual	Annual	Annual	Annual
Transformer Cooling System Control Test, Lube and Inspect	6 year	4 Year	Bimonthly	Biweekly
Transformer DGA	Annual	Annual	Annual	Annual
Transformer Dielectric - Chemical Analysis	N/A	8 Year	N/A	N/A
Transformer Dielectric Main Tank	Annual	Annual	Annual	Annual
Transformer Oil Pump Bearing Test	N/A	Annual	N/A	N/A
Transformer Power Factor	5 year	4 Year	As Req.	As Req.
Transformer Radiator Power Wash	As Needed	Biannual	As Req.	As Req.
Transformer LTC Exercise	Annual	Annual	Annual	Annual
Underground Pipeline Console Maintenance	Annual	Annual	N/A	N/A
Underground Pipeline DGA	N/A	As Req.	N/A	N/A
Underground Pipeline Dielectric	N/A	Annual	N/A	N/A
Underground Pipeline Termination DGA	N/A	As Req.	N/A	N/A
Underground Pipeline Termination Power Factor	N/A	4 Year	N/A	N/A
Underground Transmission Line N2 Pump Test	N/A	Monthly	N/A	N/A
Underground Transmission Sheathing Voltage Limiters	N/A	N/A	N/A	Annual
Underground Transmission Cathodic Protection	N/A	Monthly	N/A	Biweekly
Underground Transmission Anode Testing	N/A	Biannual	N/A	Semiannually
Emergency Generator Battery and Engine Fluid Check	N/A	N/A	N/A	Annual
Capacitor, Filter and Sample Oil	N/A	N/A	6 Years	5 Years
Voltage Transformer Testing	10 year	As Req.	As Req.	As Req.
Surge Arrester Testing	5 or 10 year	As Req.	As Req.	As Req.

<b>SCADA</b>	<b>WPS</b>	<b>WE</b>	<b>WPL</b>	<b>MGE</b>
HMI - Clean Hard Drive	As needed	Semi annual	N/A	N/A
Transducer Calibration	As needed	As req.	N/A	N/A
Inter Tie metering Calibration	As needed	N/A	N/A	N/A
Fault Recorder - operation test	Annual	Annual	As Req.	N/A

<b>Relay Testing</b>	<b>WPS</b>	<b>WE</b>	<b>WPL</b>	<b>MGE</b>
Relay Testing - Electromechanical	4 year	4 Year	5 Years	5 Years
Communication Checks	Annual	Annual	Annual	Annual
Relay Testing – Microprocessor	4 year	8 Year	As Req.	5 Years
Relay testing – Lockouts	4 year	2 Year	As Req.	N/A

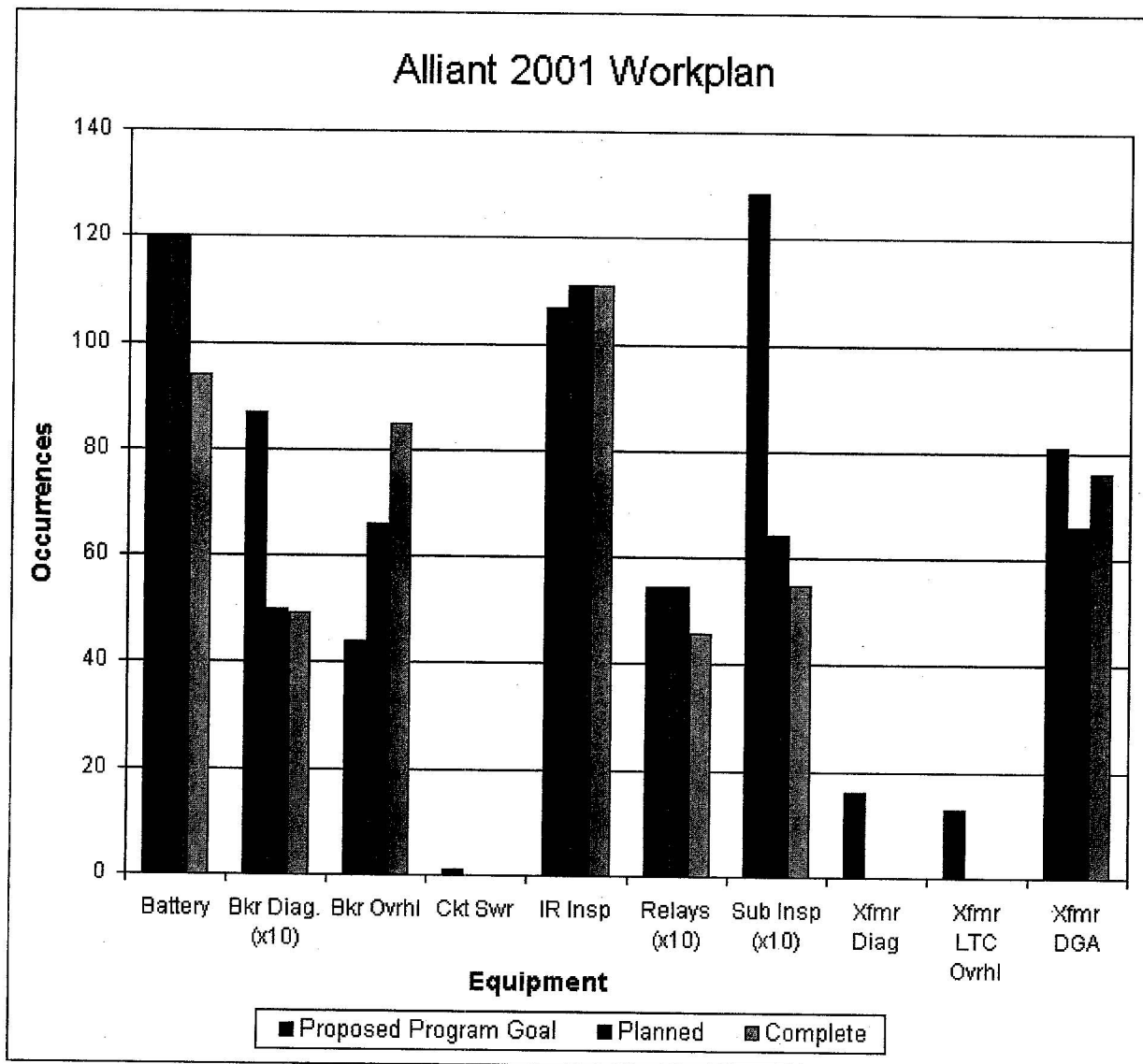
# ATC Preventive Maintenance Plan

## 2001 Alliant Workplan

(Relays totals are based per sub)

Maintenance Items	Total Equipment	Maint Cycle	Proposed Program Goal	Planned	Complete	Percent Completed
Battery	120	1	120	120	94	78%
Bkr Diag. (x10)	52.2	6	87	49.9	49.2	99%
Bkr Ovrhl	522	12	44	66	85	129%
Ckt Swr	10	8	1	0	0	0%
IR Insp	107	1	107	111	111	100%
Relays (x10)	218.4	4*	54.6	54.6	45.9	84%
Sub Insp (x10)	128.4	1	128.4	64.2	54.8	85%
Xfmr Diag	81	5	16	0	0	0%
Xfmr LTC Ovrhl	63	5	13	0	0	0%
Xfmr DGA	81	1	81	66	76	115%

\* Various cycles depending on relay type





# ATC Preventive Maintenance Plan

## Battery testing

The number of Alliant battery racks may be inaccurate.

## Breaker diagnostics

Alliant's breaker diagnostics consists of Predictive Maintenance procedures vs. Preventive Maintenance

## Sub Inspections

Alliant filed with the PSC to perform sub inspections every other month.

## Relays

Alliant is on target with their relay testing.

The percent completed is low because the substations tested this year had less relays.

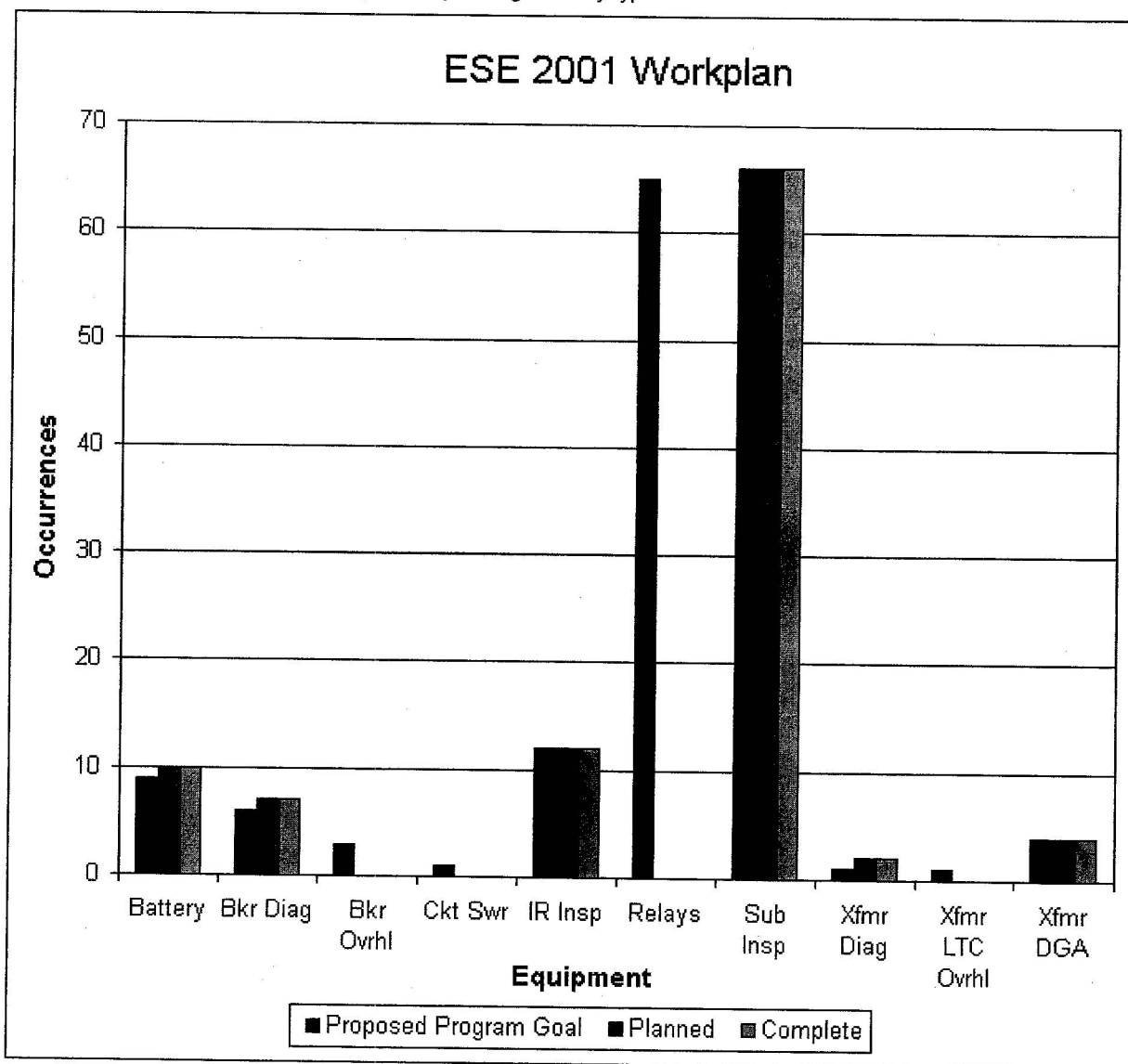
# ATC Preventive Maintenance Plan

## 2001 ESE Workplan

[Data only for last 6 months of 2001]

Maintenance Items	Total Equipment	Maint Cycle	Proposed Program Goal	Planned	Complete	Percent Completed
Battery	9	1	9	10	10	100%
Bkr Diag	38	6	6	7	7	100%
Bkr Ovrhl	38	12	3	0	0	0%
Ckt Swr	5	8	1	0	0	0%
IR Insp	12	1	12	12	12	100%
Relays	259	4*	65	0	0	0%
Sub Insp	66	1	66	66	66	100%
Xfmr Diag	4	5	1	2	2	100%
Xfmr LTC Ovrhl	3	5	1	0	0	0%
Xfmr DGA	4	1	4	4	4	100%

\* Various cycles depending on relay type

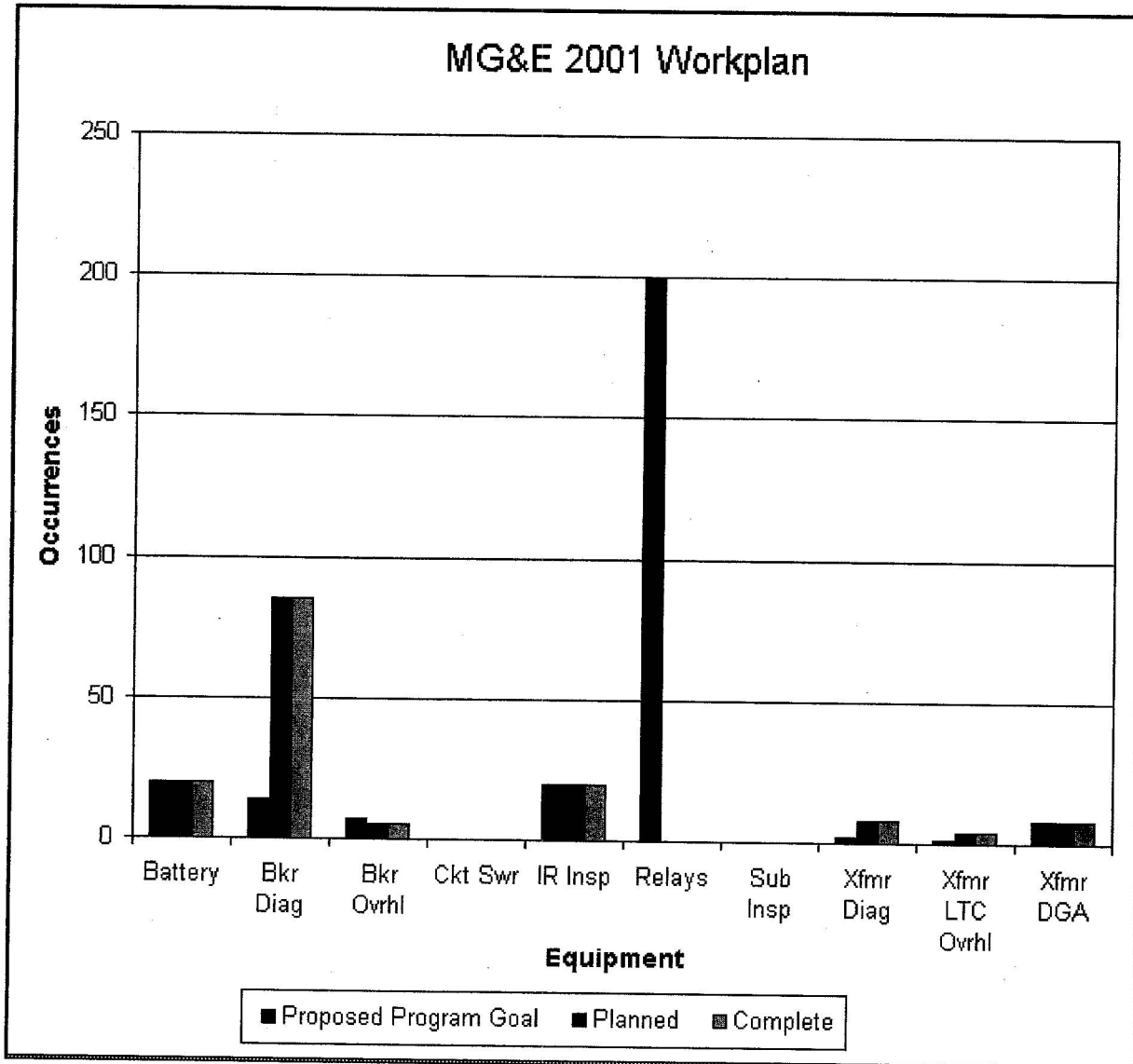


# ATC Preventive Maintenance Plan

## 2001 MG&E Workplan

Maintenance Items	Total Equipment	Maint Cycle	Proposed Program Goal	Planned	Complete	Percent Completed
Battery	20	1	20	20	20	100%
Bkr Diag	85	6	14	85	85	100%
Bkr Ovrhl	85	12	7	5	5	100%
Ckt Swr		8				#DIV/0!
IR Insp	20	1	20	20	20	100%
Relays		4*	200			#DIV/0!
Sub Insp	20	1				#DIV/0!
Xfmr Diag	8	5	2	8	8	100%
Xfmr LTC Ovrhl	4	5	1	4	4	100%
Xfmr DGA	8	1	8	8	8	100%

\* Various cycles depending on relay type



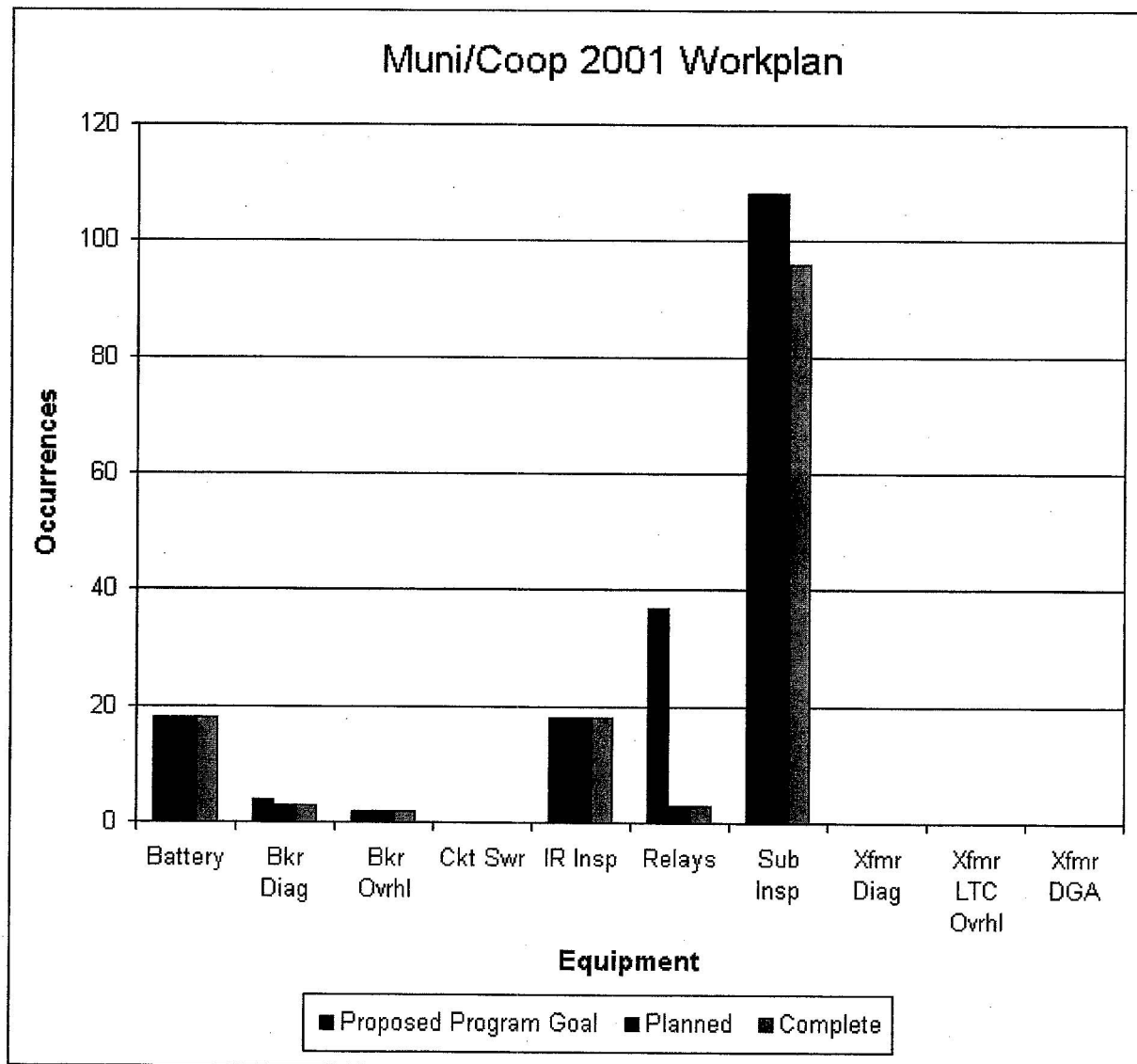
# ATC Preventive Maintenance Plan

## 2001 Municipal/Coop Workplan

[Data only for last 6 months of 2001]

Maintenance Items	Total Equipment	Maint Cycle	Proposed Program Goal	Planned	Complete	Percent Completed
Battery	18	1	18	18	18	100%
Bkr Diag	21	6	4	3	3	100%
Bkr Ovrhl	21	12	2	2	2	100%
Ckt Swr	0	8	0	0	0	0%
IR Insp	18	1	18	18	18	100%
Relays	148	4*	37	3	3	100%
Sub Insp	108	1	108	108	96	89%
Xfmr Diag	0	5	0	0	0	0%
Xfmr LTC Ovrhl	0	5	0	0	0	0%
Xfmr DGA	0	1	0	0	0	0%

\* Various cycles depending on relay type



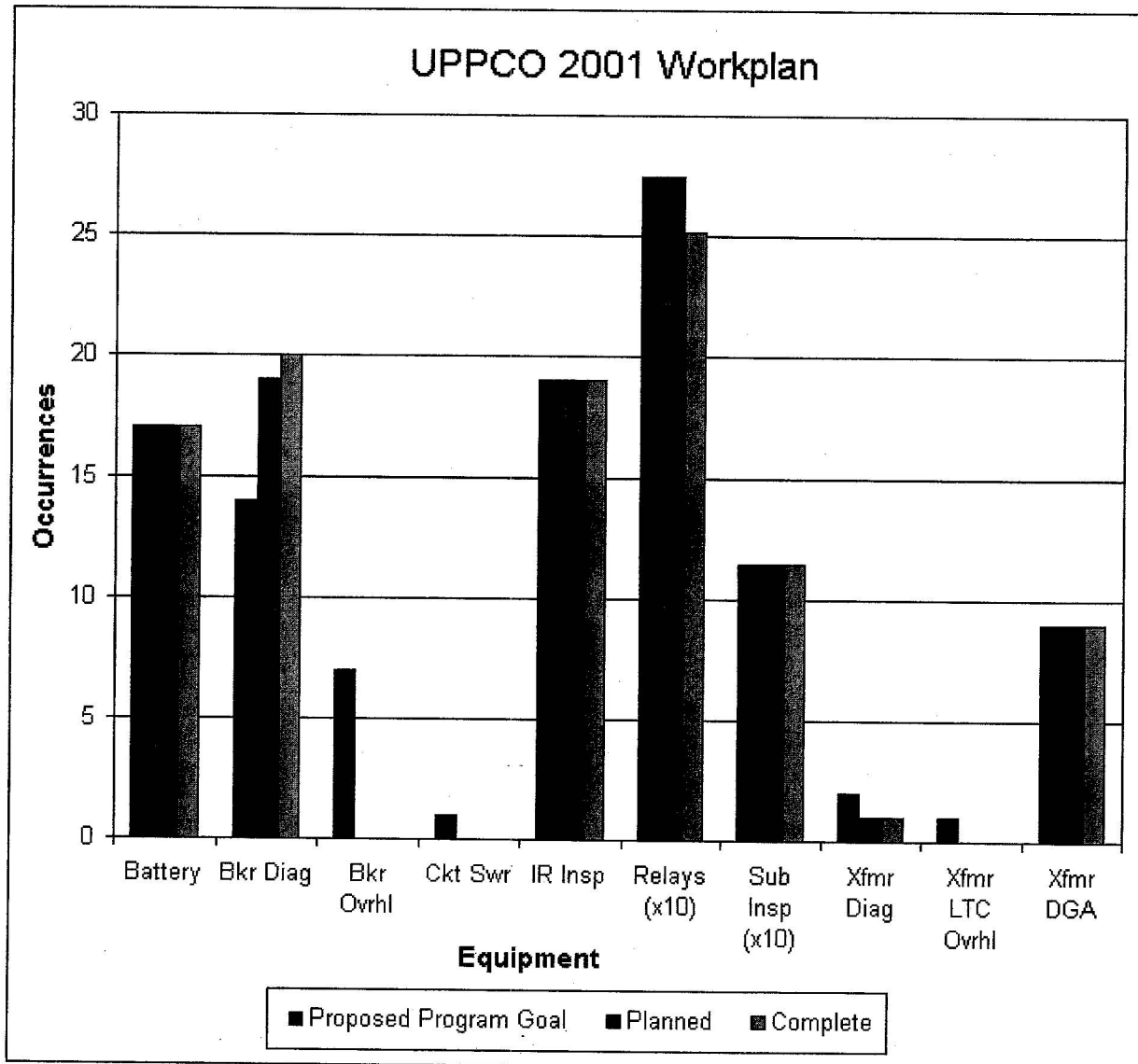
# ATC Preventive Maintenance Plan

## 2001 UPPCO Workplan

[Data only for last 6 months of 2001]

Maintenance Items	Total Equipment	Maint Cycle	Proposed Program Goal	Planned	Complete	Percent Completed
Battery	16	1	17	17	17	100%
Bkr Diag	84	6	14	19	20	105%
Bkr Ovrhl	84	12	7	0	0	0%
Ckt Swr	4	8	1	0	0	0%
IR Insp	19	1	19	19	19	100%
Relays (x10)	92.3	4*	27.5	27.5	25.2	92%
Sub Insp (x10)	11.4	1	11.4	11.4	11.4	100%
Xfmr Diag	9	5	2	1	1	100%
Xfmr LTC Ovrhl	5	5	1	0	0	0%
Xfmr DGA	9	1	9	9	9	100%

\* Various cycles depending on relay type

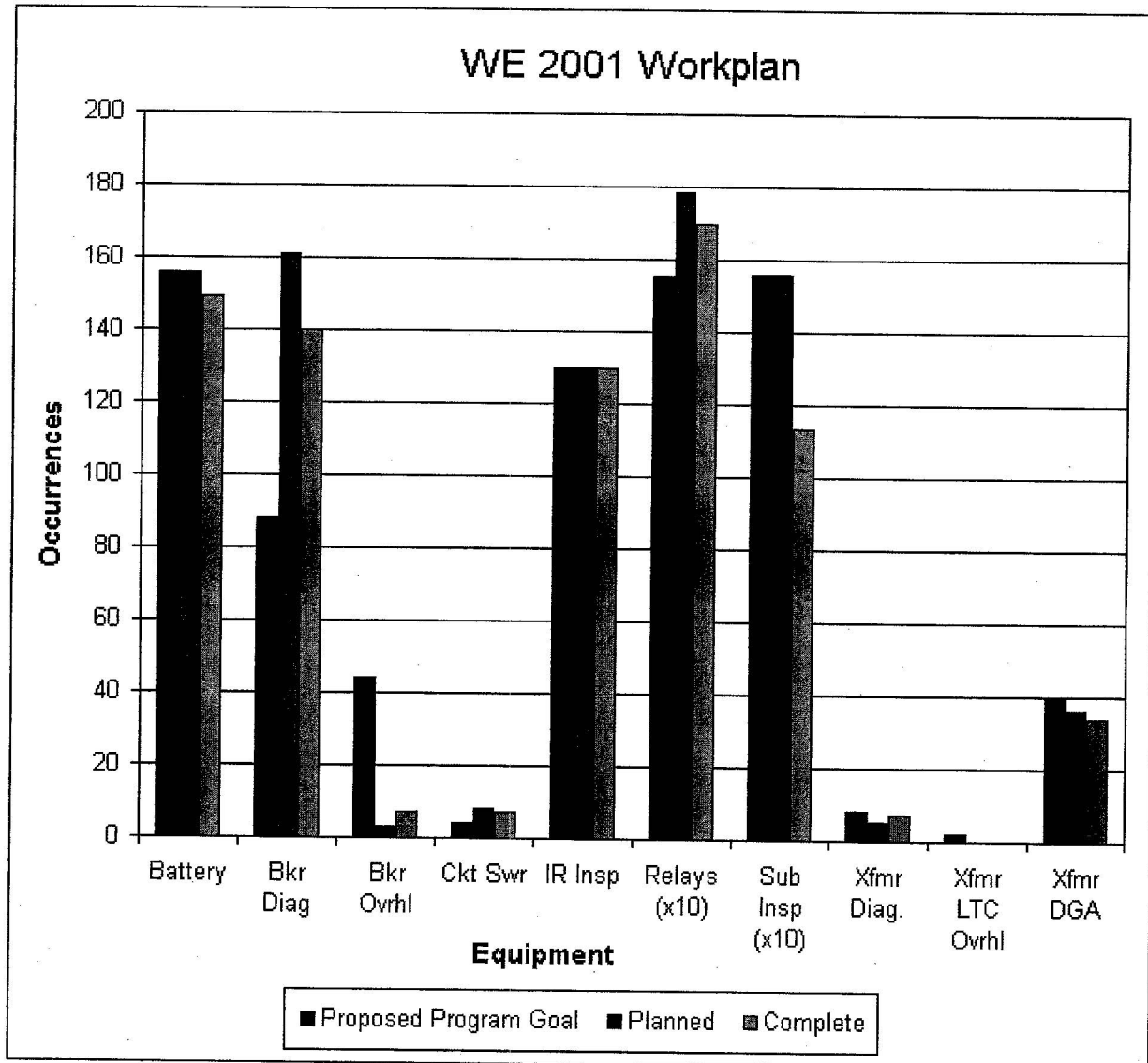


# ATC Preventive Maintenance Plan

## 2001 WE Workplan

Maintenance Items	Total Equipment	Maint Cycle	Proposed Program Goal	Planned	Complete	Percent Completed
Battery	156	1	156	156	149	96%
Bkr Diag	527	6	88	161	140	87%
Bkr Ovrhl	527	12	44	3	7	233%
Ckt Swr	28	8	4	8	7	88%
IR Insp	130	1	130	130	130	100%
Relays (x10)	621.2	4*	155.3	178.4	169.9	95%
Sub Insp (x10)	156	1	156	156	113.4	73%
Xfmr Diag.	40	5	8	5	7	140%
Xfmr LTC Ovrhl	9	5	2	0	0	0%
Xfmr DGA	40	1	40	36	34	94%

\* Various cycles depending on relay type



# ATC Preventive Maintenance Plan

## **2001 WE Workplan Exceptions**

### Breaker diagnostics

WE was unable to get equipment out of service and work load was high

### Sub Inspections

WE had a change in procedures which altered the expected and actual inspection numbers

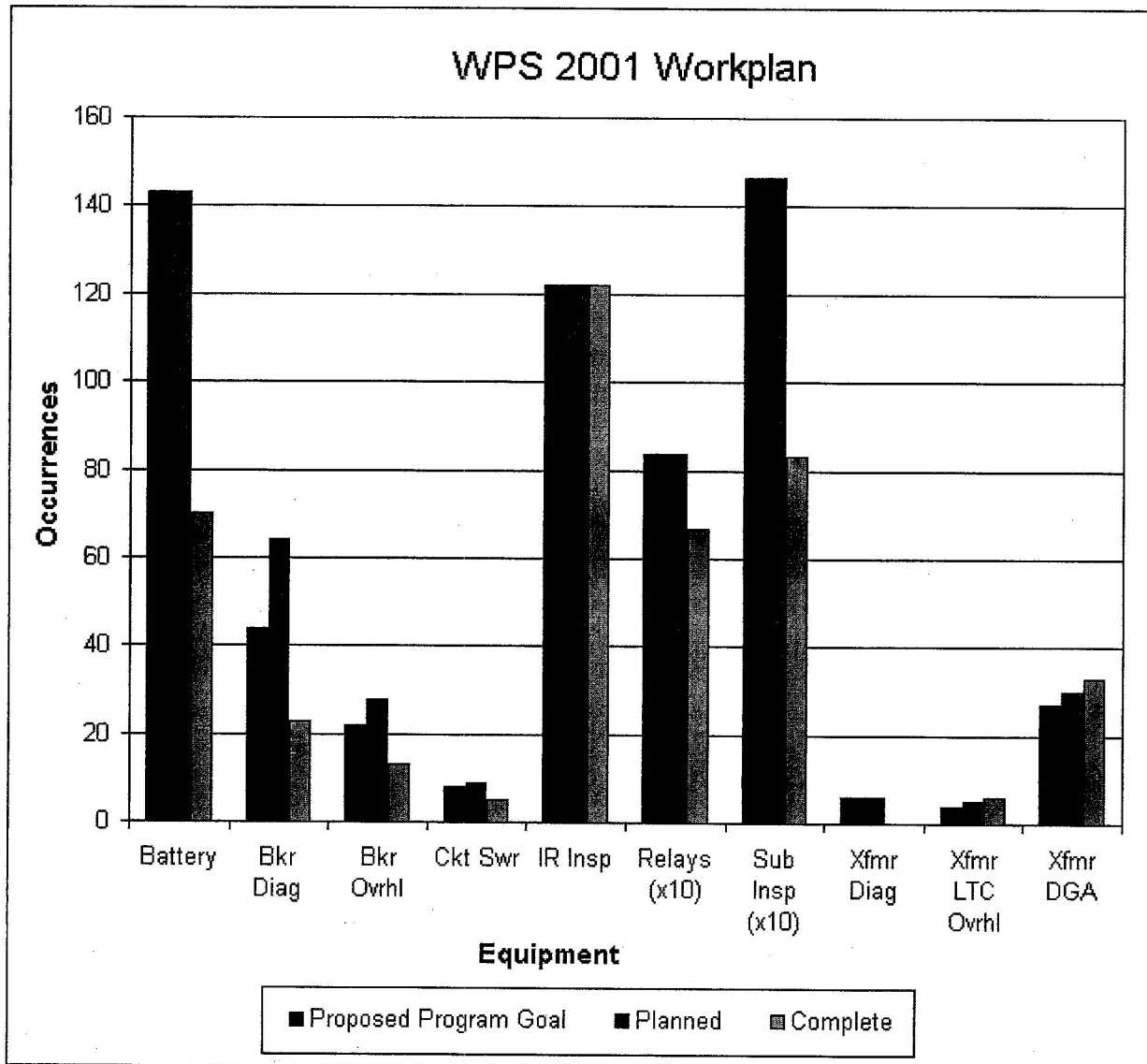
# ATC Preventive Maintenance Plan

## 2001 WPS Workplan

[Jan/Feb data may not be accurate]

Maintenance Items	Total Equipment	Maint Cycle	Proposed Program Goal	Planned	Complete	Percent Completed
Battery	143	1	143	143	70	49%
Bkr Diag	264	6	44	64	23	36%
Bkr Ovrhl	264	12	22	28	13	46%
Ckt Swr	62	8	8	9	5	56%
IR Insp	122	1	122	122	122	100%
Relays (x10)	249.7	4*	83.6	83.6	66.5	80%
Sub Insp (x10)	146.4	1	146.4	146.4	83.3	57%
Xfmr Diag	27	5	6	6	0	0%
Xfmr LTC Ovrhl	18	5	4	5	6	120%
Xfmr DGA	27	1	27	30	33	110%

\* Various cycles depending on relay type





# ATC Preventive Maintenance Plan

## **2001 WPS Workplan Exceptions**

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### Battery testing

Maintenance for 2001 was completed prior to 2001, because of WPSC workloads

### Breaker diagnostics

WPSC was unable to get equipment out of service

### Breaker overhauls

WPSC was unable to get equipment out of service

### Sub Inspections

WPSC did sub inspections every other month. They filed every month with the PSC113

### Relays

WPSC is on target with their relay testing.

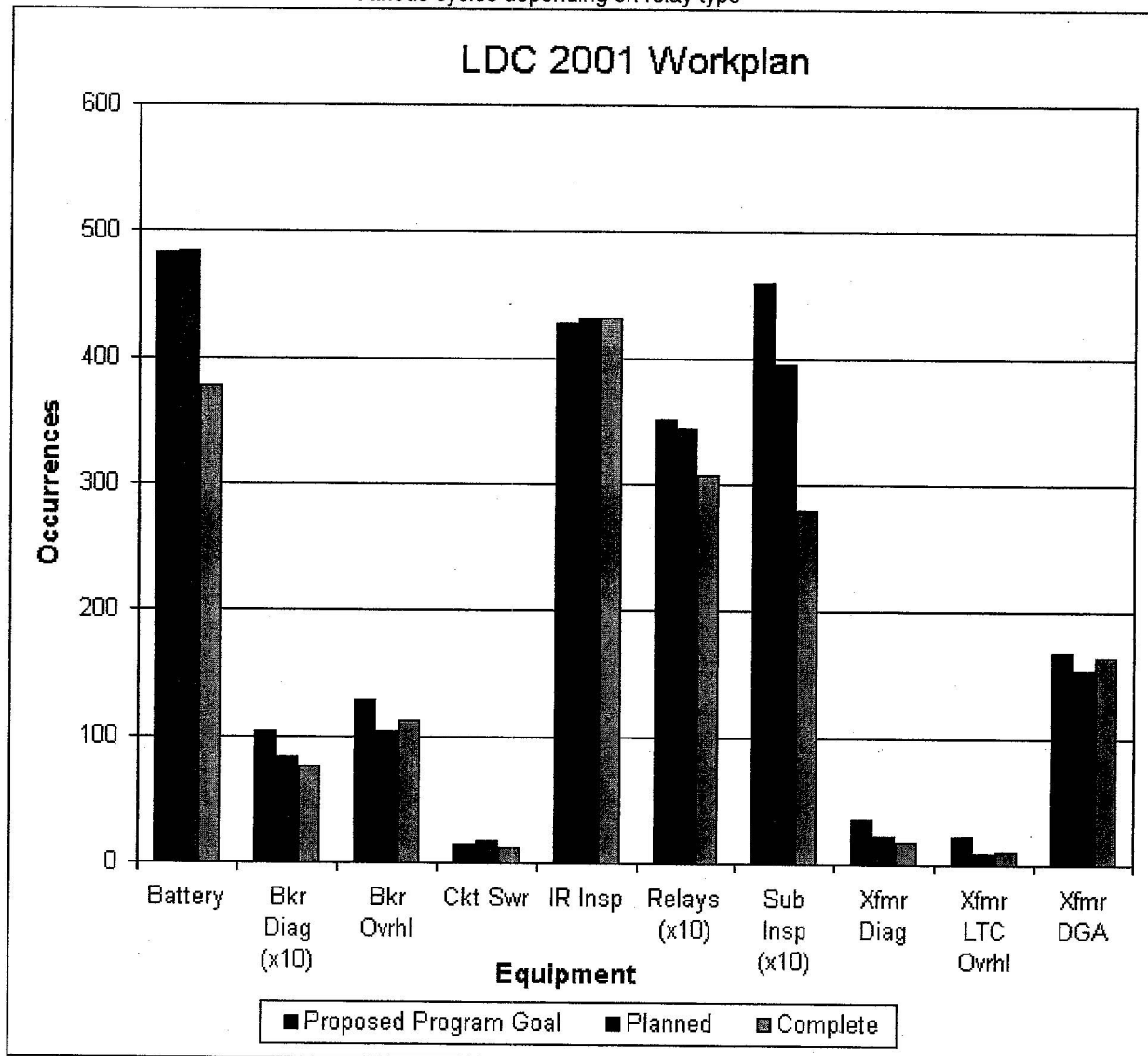
The percent completed is low because the substations tested this year had less relays.

# ATC Preventive Maintenance Plan

## 2001 LDC Totals

Maintenance Items	Total Equipment	Maint Cycle	Proposed Program Goal	Planned	Complete	Percent Completed
Battery	482	1	483	484	378	78%
Bkr Diag (x10)	152	6	103.6	83.5	76.7	92%
Bkr Ovrhl	1541	12	129	104	112	108%
Ckt Swr	109	8	15	17	12	71%
IR Insp	428	1	428	432	432	100%
Relays (x10)	1222.3	4*	351.2	344.4	307.8	89%
Sub Insp (x10)	461.6	1	459.6	395.4	279.1	71%
Xfmr Diag	169	5	35	22	18	82%
Xfmr LTC Ovrhl	102	5	22	9	10	111%
Xfmr DGA	169	1	169	153	164	107%

\* Various cycles depending on relay type

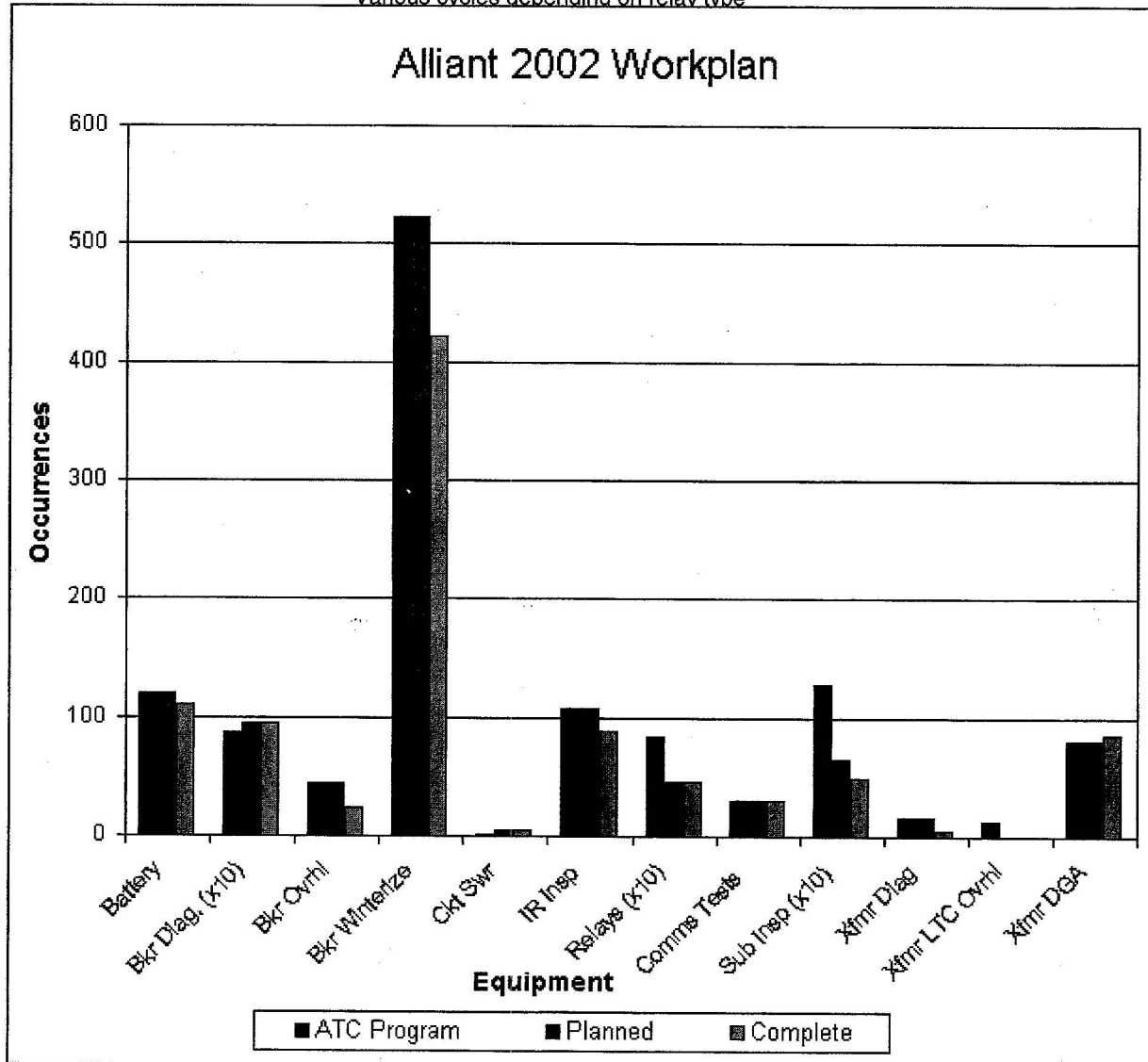


# ATC Preventive Maintenance Plan

## 2002 Alliant Workplan

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	120	1	120	120	110	92%
Bkr Diag. (x10)	52.2	6	87	95	95	100%
Bkr Ovrhl	522	12	44	44	24	55%
Bkr Winterize	522	1	522	522	422	81%
Ckt Swr	10	8	1	5	5	100%
IR Insp	107	1	107	107	88	82%
Relays (x10)	331.7	4*	82.9	45.9	45.9	100%
Comms Tests	30	1	30	30	30	100%
Sub Insp (x10)	128.4	1	128.4	64.2	49.4	77%
Xfmr Diag	81	5	16	16	4	25%
Xfmr LTC Ovrhl	63	5	13	0	0	0%
Xfmr DGA	81	1	81	81	85	105%

\* Various cycles depending on relay type



# ATC Preventive Maintenance Plan

## 2002 Alliant Workplan Exceptions

### Battery testing

### Breaker diagnostics

Alliant's breaker diagnostics consists of Predictive Maintenance procedures vs. Preventive Maintenance

### Sub Inspections

Alliant filed with the PSC to perform sub inspections every other month.

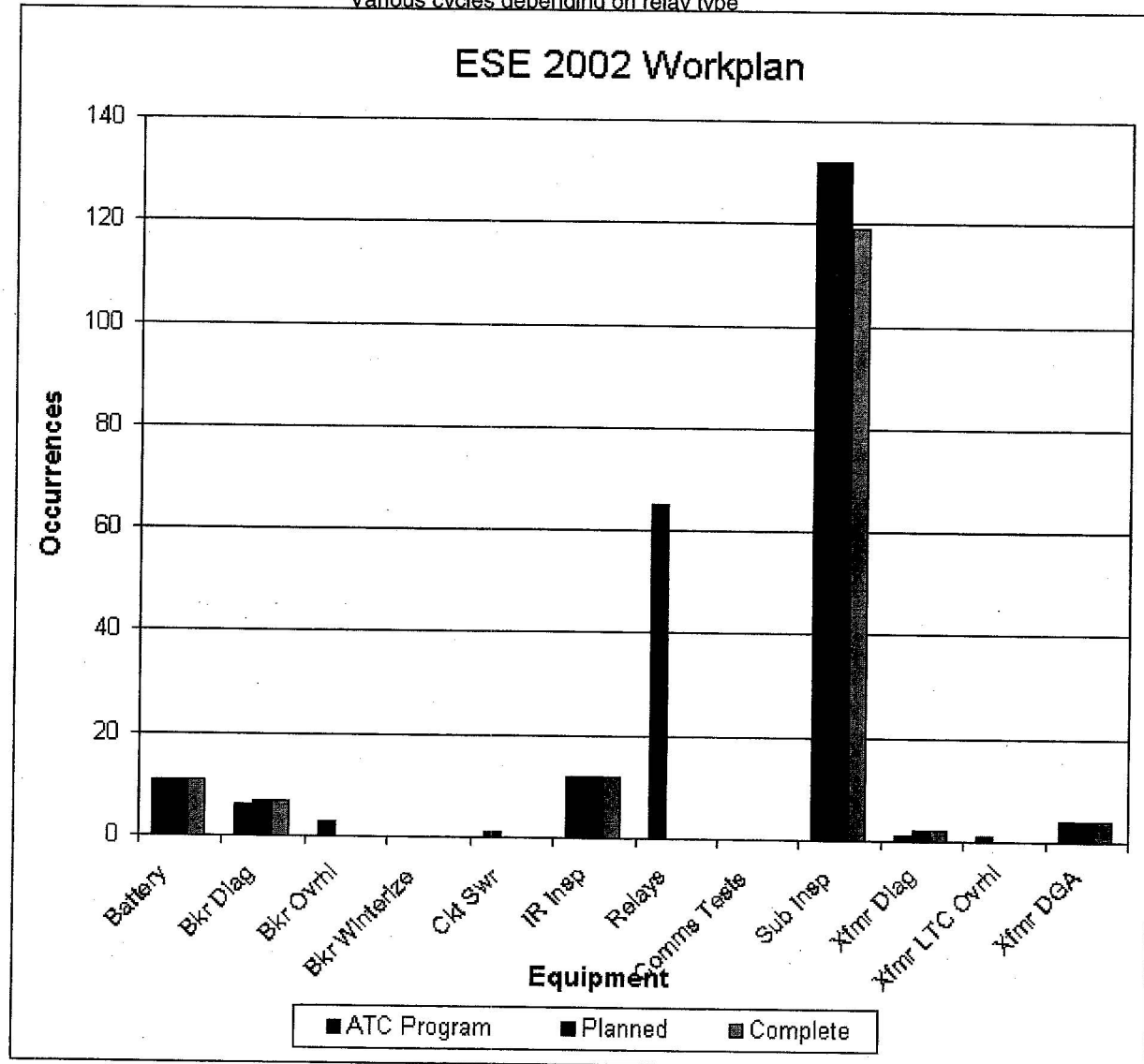
### Relays

# ATC Preventive Maintenance Plan

## 2002 ESE Workplan

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	11	1	11	11	11	100%
Bkr Diag	38	6	6	7	7	100%
Bkr Ovrhl	38	12	3	0	0	0%
Bkr Winterize						
Ckt Swr	5	8	1	0	0	0%
IR Insp	12	1	12	12	12	100%
Relays	259	4*	65	0	0	0%
Comms Tests						
Sub Insp	132	12	132	132	119	90%
Xfmr Diag	4	5	1	2	2	100%
Xfmr LTC Ovrhl	3	5	1	0	0	0%
Xfmr DGA	4	1	4	4	4	100%

\* Various cycles depending on relay type

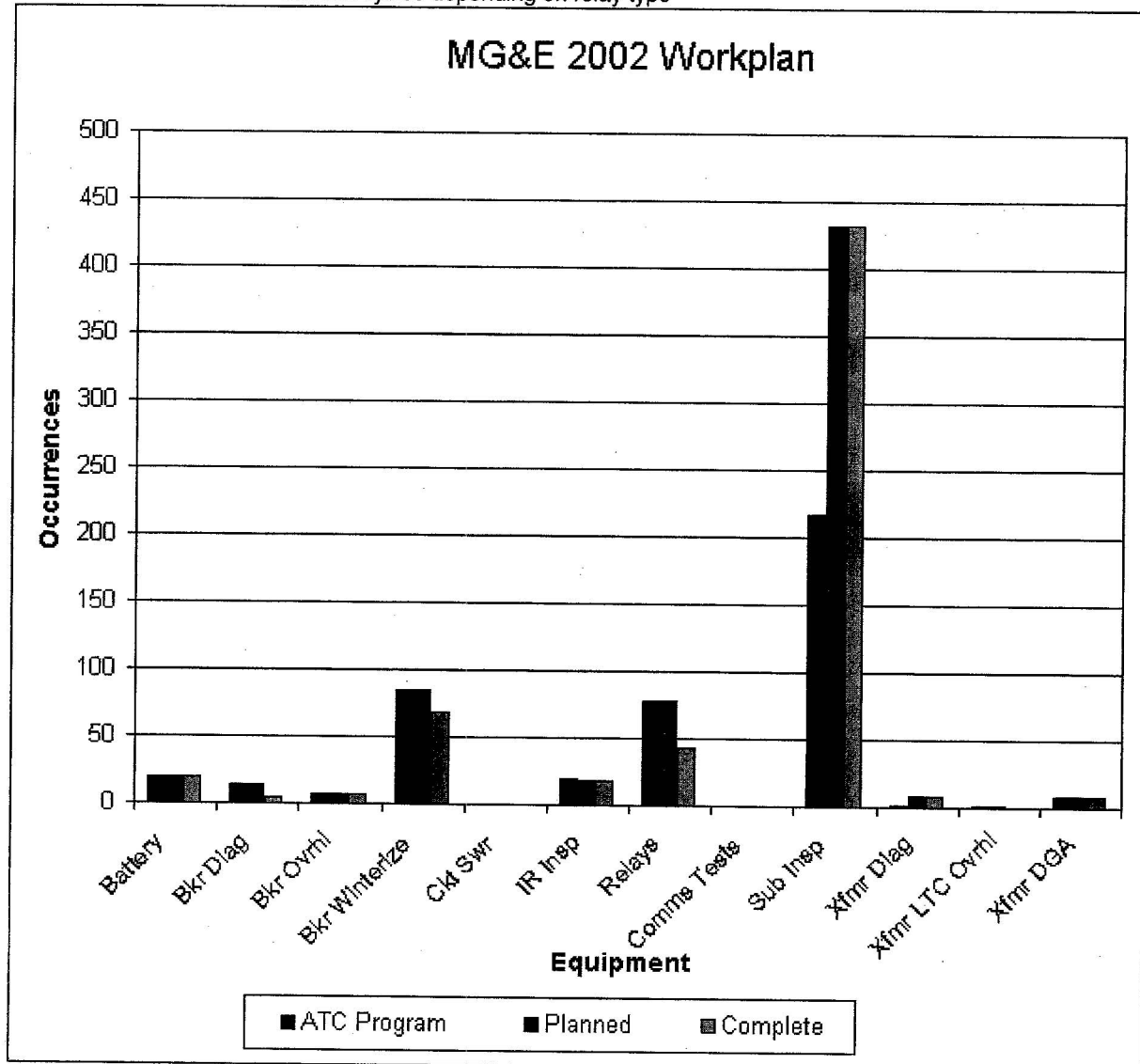


# ATC Preventive Maintenance Plan

## 2002 MG&E Workplan

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	20	1	20	20	19	95%
Bkr Diag	85	6	14	14	4	29%
Bkr Ovrhl	85	12	7	7	7	100%
Bkr Winterize	85	1	85	85	68	80%
Ckt Swr	N/A	8	N/A			0%
IR Insp	20	1	20	18	18	100%
Relays	313	4*	78	78	43	55%
Comms Tests	N/A	1	N/A			0%
Sub Insp	216	1	216	432	432	100%
Xfmr Diag	8	5	2	8	8	100%
Xfmr LTC Ovrhl	4	5	1	1	0	0%
Xfmr DGA	8	1	8	8	8	100%

\* Various cycles depending on relay type

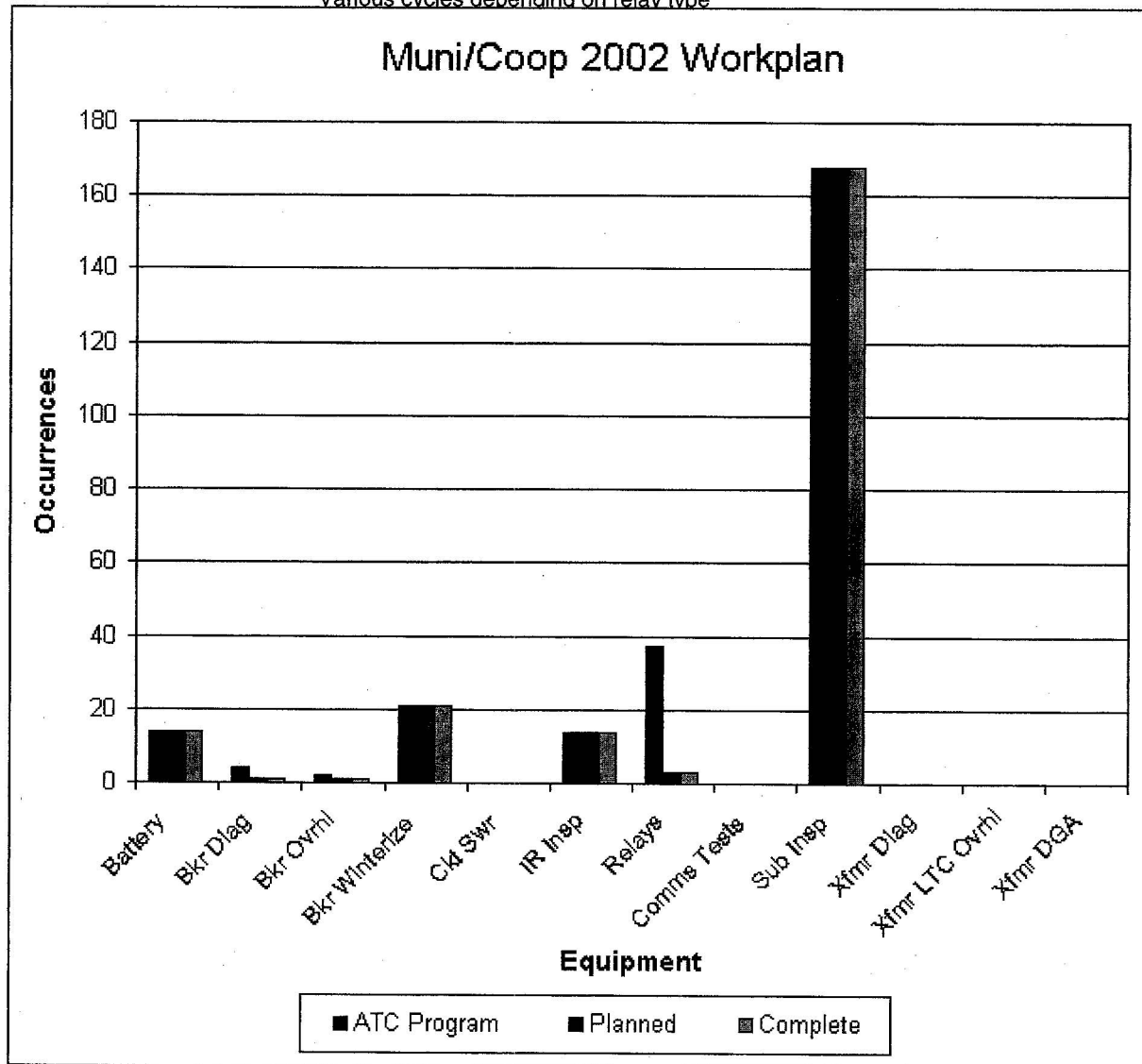


# ATC Preventive Maintenance Plan

## 2002 Municipal/Coop Workplan

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	14	1	14	14	14	100%
Bkr Diag	21	6	4	1	1	100%
Bkr Ovrhl	21	12	2	1	1	100%
Bkr Winterize	21	1	21	21	21	100%
Ckt Swr	0	8	0	0	0	0%
IR Insp	14	1	14	14	14	100%
Relays	148	4*	37	3	3	100%
Comms Tests						
Sub Insp	168	1	168	168	168	100%
Xfmr Diag	0	5	0	0	0	0%
Xfmr LTC Ovrhl	0	5	0	0	0	0%
Xfmr DGA	0	1	0	0	0	0%

\* Various cycles depending on relay type

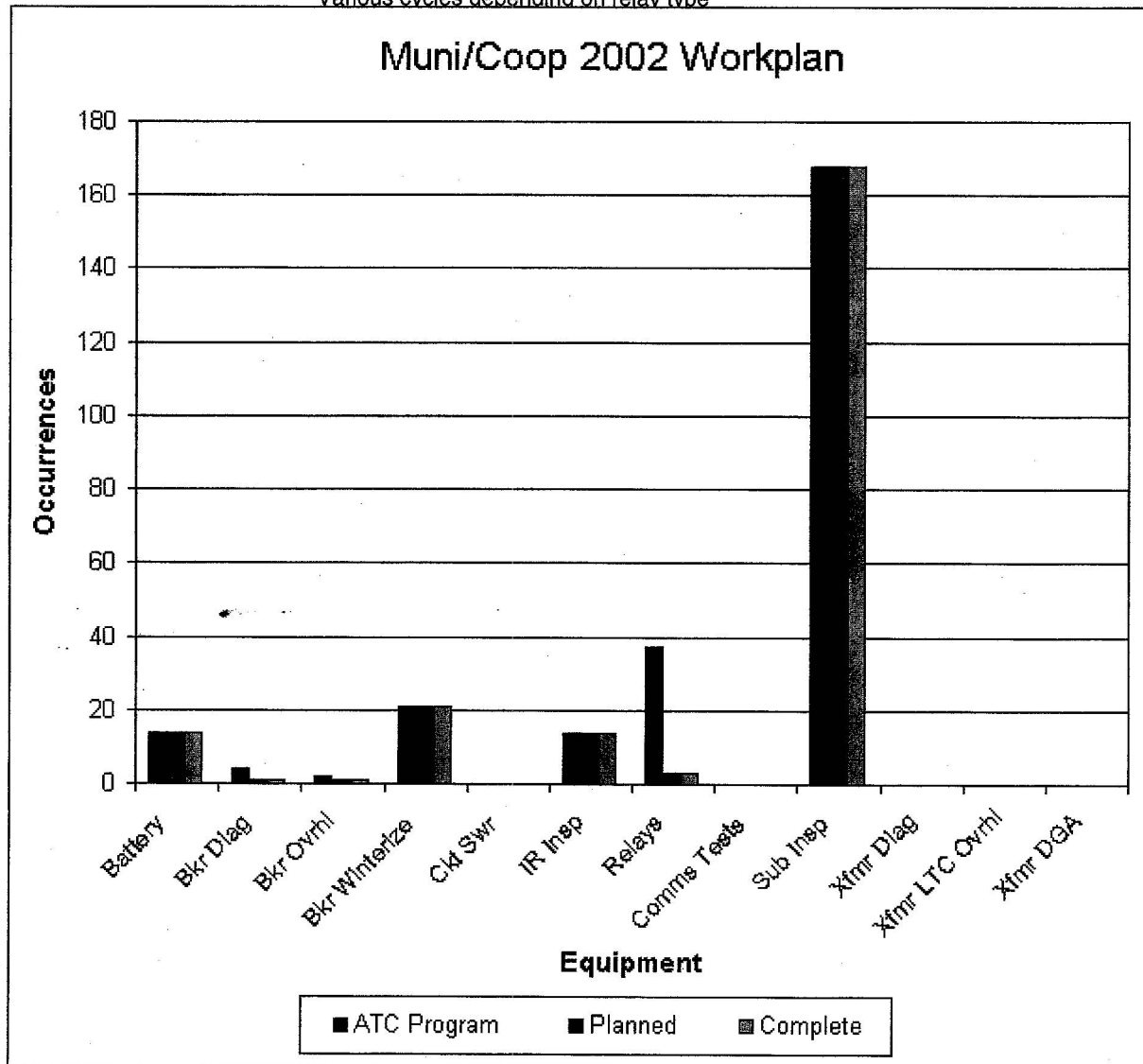


# ATC Preventive Maintenance Plan

## 2002 Municipal/Coop Workplan

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	14	1	14	14	14	100%
Bkr Diag	21	6	4	1	1	100%
Bkr Ovrhl	21	12	2	1	1	100%
Bkr Winterize	21	1	21	21	21	100%
Ckt Swr	0	8	0	0	0	0%
IR Insp	14	1	14	14	14	100%
Relays	148	4*	37	3	3	100%
Comms Tests						
Sub Insp	168	1	168	168	168	100%
Xfmr Diag	0	5	0	0	0	0%
Xfmr LTC Ovrhl	0	5	0	0	0	0%
Xfmr DGA	0	1	0	0	0	0%

\* Various cycles depending on relay type



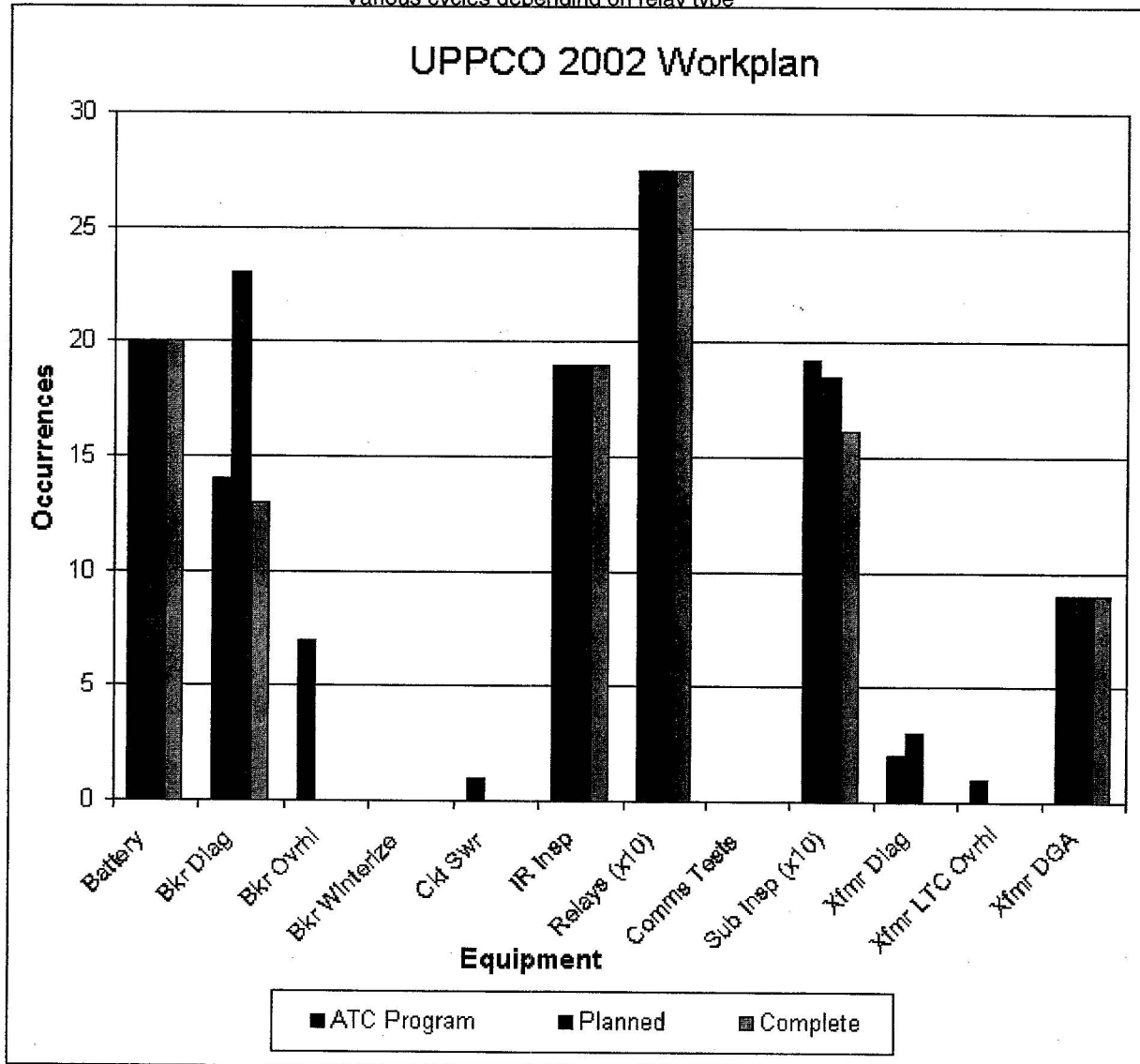


# ATC Preventive Maintenance Plan

## 2002 UPPCO Workplan

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	20	1	20	20	20	100%
Bkr Diag	84	6	14	23	13	57%
Bkr Ovrhl	84	12	7	0	0	0%
Bkr Winterize						
Ckt Swr	4	8	1	0	0	0%
IR Insp	19	1	19	19	19	100%
Relays (x10)	92.3	4*	27.5	27.5	27.5	100%
Comms Tests						
Sub Insp (x10)	19.2	1	19.2	18.5	16.1	87%
Xfmr Diag	9	5	2	3	0	0%
Xfmr LTC Ovrhl	5	5	1	0	0	0%
Xfmr DGA	9	1	9	9	9	100%

\* Various cycles depending on relay type

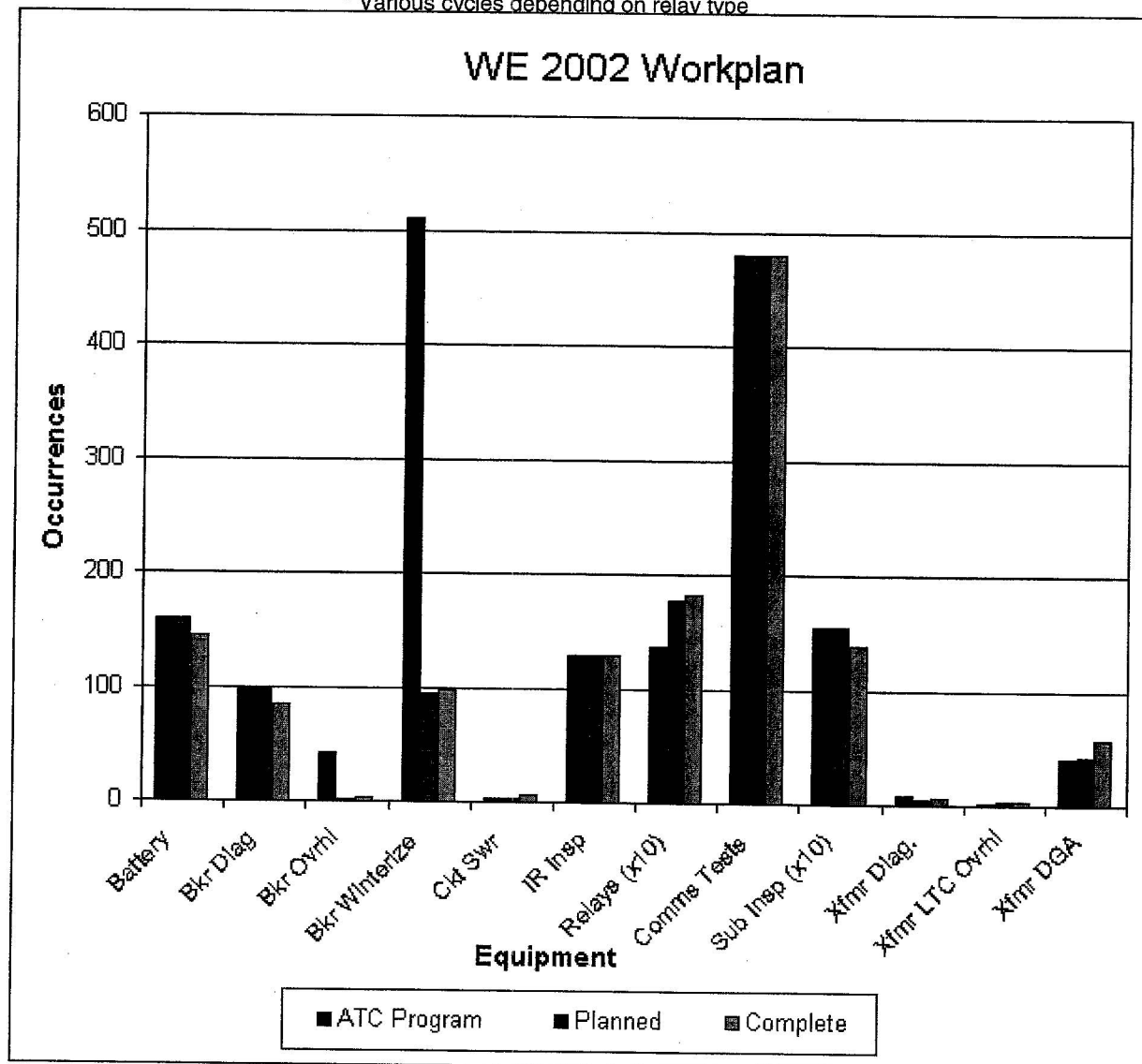


# ATC Preventive Maintenance Plan

## 2002 WE Workplan

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	160	1	160	160	145	91%
Bkr Diag	510	6	98	98	85	87%
Bkr Ovrhl	510	12	43	1	3	300%
Bkr Winterize	510	1	510	95	98	103%
Ckt Swr	26	8	4	4	6	150%
IR Insp	129	1	129	129	129	100%
Relays (x10)	547	4*	136.75	177.6	182.6	103%
Comms Tests	479	1	479	479	479	100%
Sub Insp (x10)	154.8	1	154.8	154.8	138.8	90%
Xfmr Diag.	43	5	8	5	7	140%
Xfmr LTC Ovrhl	5	5	1	3	3	100%
Xfmr DGA	43	1	40	43	57	133%

\* Various cycles depending on relay type



# ATC Preventive Maintenance Plan

## **2002 WE Workplan Exceptions**

### Breaker diagnostics

WE was unable to get equipment out of service and work load was high

### Sub Inspections

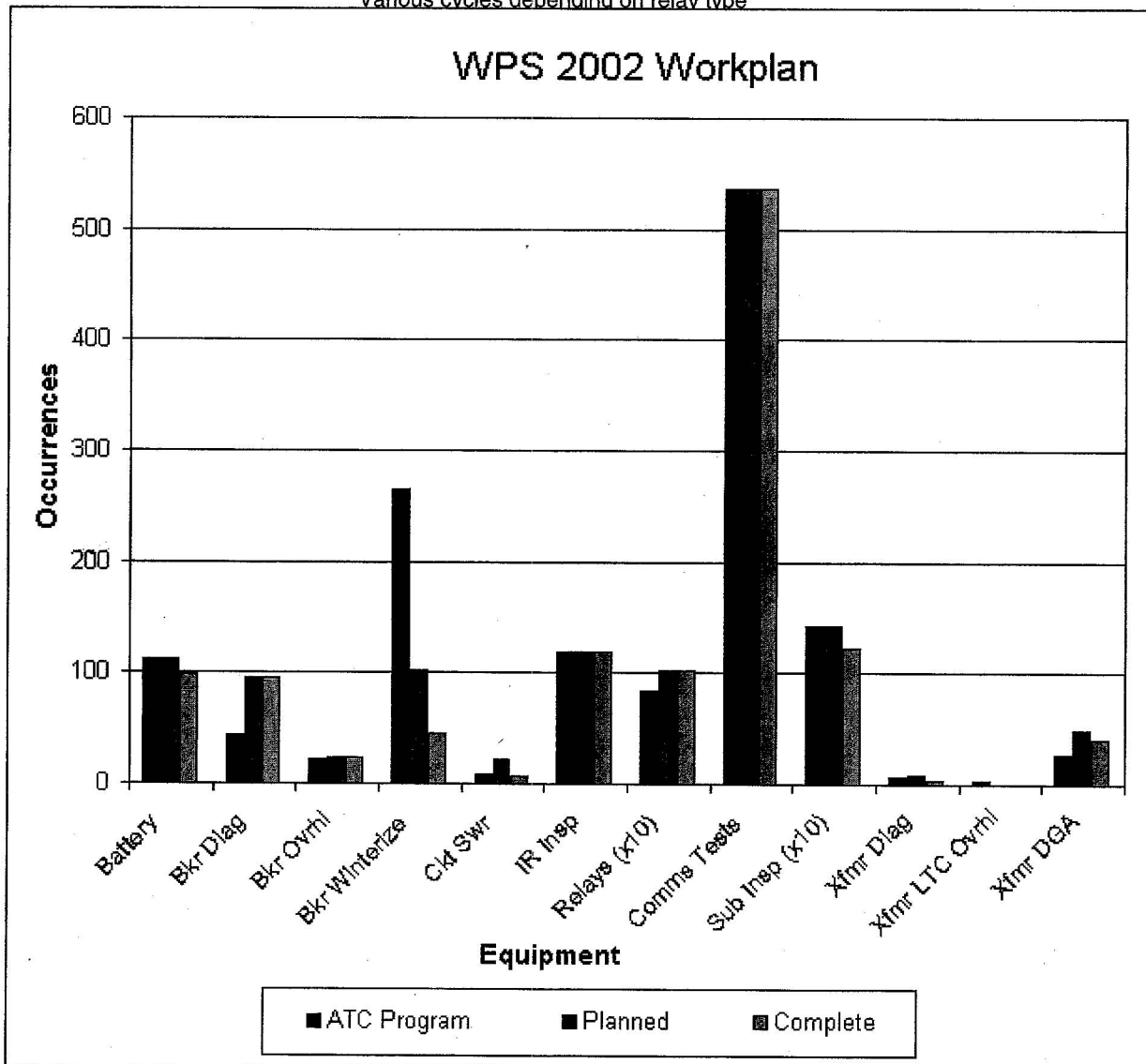
WE had a change in procedures which altered the expected and actual inspection numbers

# ATC Preventive Maintenance Plan

## 2002 WPS Workplan

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	119	1	113	113	99	88%
Bkr Diag	264	6	44	95	95	100%
Bkr Ovrhl	264	12	22	24	24	100%
Bkr Winterize	264	1	264	103	46	45%
Ckt Swr	62	8	8	21	7	33%
IR Insp	119	1	119	119	119	100%
Relays (x10)	249.7	4*	83.6	102.5	102.5	100%
Comms Tests	536	1	536	536	536	100%
Sub Insp (x10)	142.8	1	142.8	142.8	121.7	85%
Xfmr Diag	27	5	6	8	3	38%
Xfmr LTC Ovrhl	18	5	4	0	0	0%
Xfmr DGA	27	1	27	48	41	85%

\* Various cycles depending on relay type



# ATC Preventive Maintenance Plan

## 2002 WPS Workplan Exceptions

### Battery testing

Some of the batteries were tested prior 2002 due to work load. And some are being tested after 2002 for same reason.

### Crkt Switcher

Changed due to ATC new test schedule

### LTC Overhaul

Was decided to leave go until 2003 due to addition of filter systems and new agreement with High Voltage Supply will be completed in 2003

### Sub Inspections

Substations were missed during inspections due to construction projects going on. Subs were inspected just crews made no formal notation.

### Transformer Diagnostics

To be completed with LTC overhauls and filter additions in 2003

### Circuit Breaker Winterize

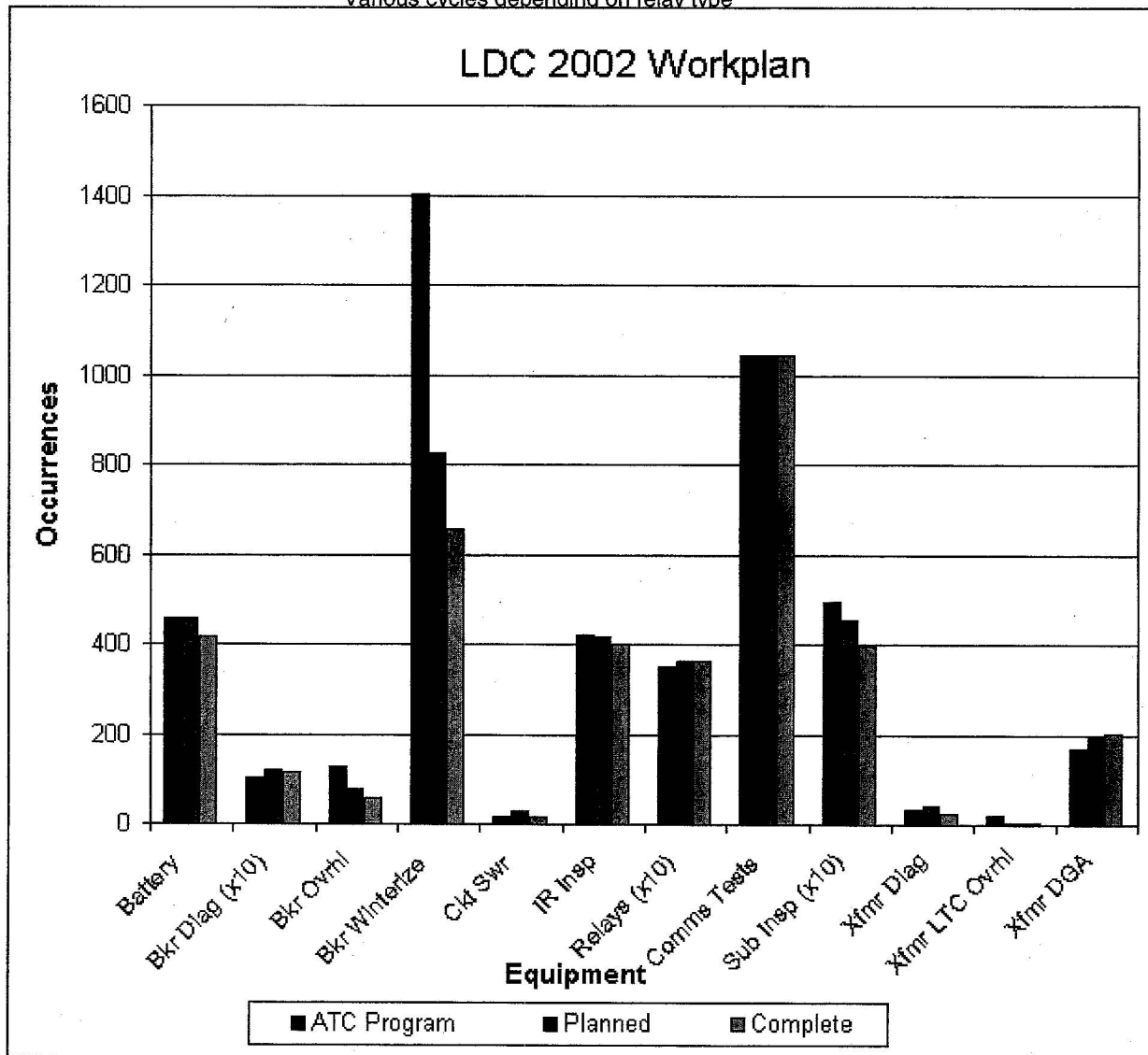
This is the one area that has to be improved upon and I am in the process of working with WPS on this task.

# ATC Preventive Maintenance Plan

## 2002 LDC Totals

Maintenance Items	Total Equipment	Maint Cycle	ATC Program	Planned	Complete	Percent Completed
Battery	464	1	458	458	418	91%
Bkr Diag (x10)	150	6	105	119	115	97%
Bkr Ovrhl	1524	12	128	77	59	77%
Bkr Winterize	1402	1	1402	826	655	79%
Ckt Swr	107	8	15	30	18	60%
IR Insp	420	1	420	418	399	95%
Relays (x10)	1292.7	4*	348.8	361.6	363.1	100%
Comms Tests	1045	1	1045	1045	1045	100%
Sub Insp (x10)	496.8	1	496.8	453.5	397.9	88%
Xfmr Diag	172	5	35	42	24	57%
Xfmr LTC Ovrhl	98	5	21	4	3	75%
Xfmr DGA	172	1	169	193	204	106%

\* Various cycles depending on relay type



# **ATC Preventive Maintenance Plan**

## **3.0 ATC Preventive Maintenance Plan**

### **3.1 Introduction**

The ATC Maintenance and Inspection Staff is responsible for the maintenance of the ATC transmission system through this contracted relationship with the contributors. This staff monitors the progress of the contributing utilities in the execution of the work plan, provides guidance and direction to the utility contractors and works with the utility contractors on quarterly revisions to the plan. The staff consists of Transmission Line Maintenance Specialists and Substation Maintenance Specialists and Support Engineers who are located in Kingsford, Michigan, and DePere, Pewaukee, and Cottage Grove, Wisconsin.

The ATC Maintenance Staff has developed a uniform maintenance program for application to all ATC facilities and will be deploying an ATC computerized maintenance management system for use by contractors and local distribution companies who perform maintenance and inspections for ATC. For the years 2001 and 2002, the legacy maintenance plans of the contributors, as filed in the June 2001 PSCW 133 filing, were used with some migration towards the ATC program where possible.

The computerized maintenance management system will allow the ATC staff to prioritize expenditures across the entire ATC, manage work more closely, minimize the work to generate reports and better manage costs. The deployment of this system, Cascade, is scheduled as follows;

Fall 2003	Wisconsin Public Service
Fall 2003	Madison Gas and Electric
Spring 2004	Wisconsin Power and Light
Summer/Fall 2004	We Energies
Fall/Winter 2004	UPPCo., Edison Sault, Cloverland (Michigan)

Cascade will not be deployed to the Municipal and Cooperatives contributors in Wisconsin. It was not cost effective for the limited number of assets contributed. These assets will be in the Cascade system but data management/input will be performed by the ATC maintenance staff.

The specifics of the ATC Preventive Maintenance Program are described below.

### **3.2 Reporting Methods/Requirements**

#### **3.2.1 T-Line & Substation**

## ATC Preventive Maintenance Plan

- 3.2.1.1 The purpose of this plan is to improve the electrical system reliability with the objective of obtaining increased loyalty, satisfaction, and support from our customers. The ATC goals are to meet the schedules established in this plan.
- 3.2.1.2 Exception reporting (inspected equipment not in “Good Condition”) will be the method of documentation on all inspection forms.
- 3.2.1.3 The scope of this plan utilizes traditional and proven maintenance techniques. Unique operating and maintenance philosophies may be applied for special circumstances and/or as technology and equipment manufactures develop new products. Also, manufacturer defects shall be dealt with as they are communicated to the ATC.
- 3.2.1.4 A report and summary of this plan’s progress shall be submitted to the Public Service Commission of Wisconsin every two years. The report will consist of information documenting the ATC’s implementation of this plan as well as spreadsheets containing pertinent information with regards to exception items reported during inspections.

### 3.3 Condition Rating Criteria (T-Line & Substation)

#### 3.3.1 T-Line & Substation

- 3.3.1.1 Facilities are inspected to verify proper condition of equipment and to identify conditions that may cause equipment damage, service interruptions, or hazardous conditions. Maintenance is completed commensurate with the rating of the reported conditions. Abnormalities (“Fair Condition” to “Non-Critical Maintenance Required”) found are recorded and tracked for maintenance scheduling. “Priority Maintenance” and “Urgent Maintenance” conditions found in the field are scheduled for maintenance work as necessary.
- 3.3.1.2 Scheduled inspections and follow-up maintenance ensure high quality, safe, and reliable service considering: cost, geography, weather, applicable codes, national industry practices, sound engineering judgment, and experience.
  - (1) The rating criteria listed below shall establish the condition of a facility and also determine the repair schedule to correct deficiencies:
  - (2) **Fair Condition** – Maintenance may not be required.



## **ATC Preventive Maintenance Plan**

- (3) **Non-Critical Maintenance Required** – Maintenance is completed as time permits, typically completed within one-year.
- (4) **Priority Maintenance required** - Maintenance is completed typically within 90-days.
- (5) **Urgent Maintenance Required** – Maintenance process is begun as soon as the problem is reported.

### **3.4 Corrective Action Schedule**

#### **3.4.1 T-Line & Substation**

- 3.4.1.1 The rating criteria as listed above shall determine the corrective action schedule. Maintenance schedules are added to the ATC's budget as directed by the Substation and Transmission Line Maintenance Specialists. Budgets for minor maintenance activities are based on historical data. Major activity's are generally identified at-least a year in advance and budgeted accordingly.
- 3.4.1.2 The ATC's Maintenance Specialists work closely with the maintenance supervision of the local distribution companies. The Facility Plans associated with the O&M agreement are the mechanism for the contributing utility to plan for necessary labor resources, and ATC for budgetary planning. The Facility Plans include provisions for unplanned maintenance. If the costs associated with the unplanned maintenance begin to exceed the amount anticipated or budgeted for the year, ATC may have to reschedule planned maintenance tasks to accommodate the additional unplanned maintenance work. Through the quarterly Facility Plan update process, adjustments can be made to future quarters to balance the labor and financial resources.

### **3.5 Record Keeping**

#### **3.5.1 T-Line & Substation**

- 3.5.1.1 The ATC shall maintain records to allow auditing of its Preventive maintenance plan implementation. The records shall include inspection dates, condition rating, schedule for repair (if applicable) and the date of completion of the repair. Inspection and repair records shall be retained for a minimum of ten years.

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## 3.6 Overhead T-Line Maintenance/Inspection Plan

### 3.6.1 Overhead T-Line Inspection Schedule

3.6.1.1 The ATC owns, operates, and maintains 69kV, 115kV, 138kV, 161kV, 230kV, and 345kV, overhead transmission line facilities.

Overhead Transmission Line Inspection Schedule		
Item	Interval	Inspection Forms Documented
Aerial Patrol		
Circuit Patrol	2/Year	Transmission Line "Aerial" Exception Report
Forestry Patrol (Summer)	1/Year	
Ground Patrol	1-4 Years	Transmission Line "Foot Patrol" Exception Report
Wood Pole Ground Line Inspection	10-Year	Report of Work Required/Completed (Provided by Contractor)
Forestry Management	5-Year	Transmission Line Forestry Maintenance Schedule
Special Inspection	As Needed	As Needed
Climbing Inspection	As Needed	N/A
Infrared	N/A	N/A

3.6.1.2 Aerial/Helicopter circuit patrols of ATC transmission lines are performed twice annually (Spring and Fall). Aerial/Helicopter forestry patrols of ATC transmission lines are performed annually (Summer). Emergency patrols following automatic operation of line protective relaying are performed on as-needed basis.

3.6.1.3 Ground patrols are performed using several means of conveyance based upon the location and topology of the right-of-way. Pick-up trucks, all-terrain vehicles, and snowmobiles are all commonly used. Frequency of "Foot Patrol" inspection's are determined by the corresponding Transmission Line Specialist based upon criticality, age, construction type, and history of the individual line.

3.6.1.4 Wood-pole ground line inspection and treatment is performed by a contracted service, which provide reports to ATC regarding condition and treatment that had been applied to the poles. Wood-pole transmission lines receive a ground line inspection at 20-years of age and subsequent inspections at 10-year intervals.

3.6.1.5 The transmission line forestry management program for ATC is based on a 5-year cycle. Forestry control may include, but is not limited to, tree

## ATC Preventive Maintenance Plan

trimming/removal, mowing, and herbicide application. The forestry management schedule is being developed based upon existing forestry conditions. ATC is presently addressing/scheduling forestry maintenance on a worst-case basis. ATC is also maintaining records of work being completed as well as attempting to identify, organize, and document the forestry work that had been completed in the past. Upon evaluation of existing forestry conditions with our Transmission line assets, it is ATC's intent to develop a forestry maintenance schedule based upon a 5-year cycle.

- 3.6.1.6 After any transmission line fault that causes an extended outage, and after the necessary switching procedures have been completed to isolate the fault, a special inspection shall be made to locate the trouble and determine the extent of repairs necessary.

ATC System Operating shall contact the appropriate local distribution companies for dispatching of proper personnel by the substation and/or transmission supervisors in charge of maintaining that section of line. ATC System Operating shall also notify the proper ATC Substation and Transmission Line Specialist's responsible for overseeing work completed within that particular region of the transmission system.

The local distribution company's supervisor shall be responsible for coordinating the necessary ground and/or aerial patrols of the line, as well as maintaining communication with ATC System Operating and Maintenance Specialist personnel as to their findings and recommended repair work. It is important that proper and effective communications are maintained between the respective groups during this process of identifying and coordinating the repair efforts.

If the outage is momentary, ATC System Operating shall notify the proper ATC Maintenance personnel to decide weather or not an inspection of the line is necessary.

Note: Any time that a special inspection has been completed, the appropriate ATC Maintenance Specialist personnel shall be responsible for initiating the proper maintenance forms/reports for completion and documentation of the unplanned maintenance work completed.

- 3.6.1.7 Climbing inspections are only utilized on an as needed basis in response to known hardware or structural problems.
- 3.6.1.8 Infrared inspections of transmission line switches in the vicinity of substations are performed along with the substation infrared inspection.

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## 3.7 Checklist – O.H. T-Line Aerial “Circuit” Patrol

### 3.7.1 Wood Structures

- Chevrons (aerial markers to patrol aircraft) in place and legible
- Structures leaning or twisted (2-feet or more)
- Deteriorated structures (rotting/splitting)
- Structures with members missing, loose, or severely bent
- Burn marks (pole fire damage)
- Bird (woodpecker) Damage to Structures
- Foreign objects attached to structures (signs, fences, deer-stands, ...etc.)
- Vines on structures and down guys
- Ground line erosion (washed out or deteriorated)

### 3.7.2 Metal Structures

- Loose structural elements
- Oxidation (rusting)
- Deteriorated foundations/footings (cracked, leaning, uplifted, exposed, or eroded)

### 3.7.3 Conductors and Shield Wires

- Foreign objects blown or thrown into conductors
- Broken, chipped, or flashed insulators
- Floating insulators (uplift)
- Damaged or unstranding of conductors (including shield wire)
- Dampers (slipped away from structure, missing, or bent)
- Damaged armor rods, tie wires, or strain/suspension clamps
- Tension Sleeves (bird caging)
- Damaged lightning protector tubes
- Conductor clearances (horizontal, vertical, diagonal per applicable electric codes)

### 3.7.4 Crossarms

- Damaged, broken, decaying, or split crossarms or braces

### 3.7.5 Hardware

- Items bent, twisted, or pulling/pushing out or into support

### 3.7.6 Grounds

## **ATC Preventive Maintenance Plan**

- Ground wires (broken, loose, or missing)
- Proper bonding

### **3.7.7 Guys and Anchors**

- Slack, broken, damaged or rusting guys
- Un-insulated down guys
- Broken or damaged guy strain insulators
- Guy markers (damaged or missing)

### **3.7.8 Right of Way**

- Grade changes/excavation within immediate area of transmission line R/W
- Buildings or other encroachments within transmission line R/W
- Flammable material located within R/W (i.e. brush burning, gas storage, ...etc.)
- Physical protection of structures has been compromised
- Any new power or communication lines constructed within Transmission Line R/W
- Forestry concerns:
  - Insufficient tree clearances
  - Dead or dying trees or branches that compromise the line (danger trees)

### **3.7.9 General**

- Any sign of unusual activity, such as parties, recreational vehicles, children playing, ...etc.

## **3.8 O.H. T-Line Aerial "Forestry" Patrol**

- 3.8.1 The forestry patrol is typically flown during the summer months when foliage is at a peak. This patrol is flown at a higher rate of speed, and the inspector is instructed to place a high emphasis on forestry conditions. However, the inspector may recognize any of the aforementioned "Aerial Circuit Patrol" concerns that have been listed.

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### 3.9 O.H. T-Line Aerial Patrol Exception Reporting Form

[illegible]

# ATC Preventive Maintenance Plan

## 3.10 Checklist – O.H. T-Line “Ground” Patrol

### 3.10.1 Poles

- Structures leaning or twisted (2-feet or more)
- Tangent structures
- Angle structures
- Dead-end structures
- Deteriorated structures (rotting/splitting)
- Structures with members missing, loose, or severely bent
- Burn marks (pole fire damage)
- Bird (woodpecker) Damage to Structures
- Pole steps (8-feet above ground)
- Foreign objects attached to structures (signs, fences, deer-stands, etc.)
- Vines on structures and down guys
- Damaged, broken, or deteriorated reinforcement pole stubs
- Ground line erosion (washed out or deteriorated)
- Danger/warning signs on structures (missing or illegible)
- Structure numbering (missing or illegible)

### 3.10.2 Metal Structures

- Loose structural elements
- Missing arm bolts
- Oxidation (rusting)
- Deteriorated foundations/footings (cracked, leaning, uplifted, exposed, or eroded)
- Climbable structures (condition of anti-climbing devices if present)

### 3.10.3 Conductors and Shield Wires

- Foreign objects blown or thrown into conductors
- Broken, chipped, flashed, or noisy insulators
- Floating insulators (uplift)
- Suspension Insulators (cotter keys in place)
- Damaged or unstranding of conductors (including shield wire)
- Dampers (slipped away from structure, missing, or bent)
- Damaged armor rods, tie wires, or strain/suspension clamps
- Tension Sleeves (bird caging)
- Damaged lightning protector tubes
- Conductor clearances (horizontal, vertical, diagonal per applicable electric codes)

# ATC Preventive Maintenance Plan

## 3.10.4 Crossarms

- Damaged, broken, decaying, or split crossarms or braces
- Wood crossarm pins decaying
- Loose carriage bolts or lags

## 3.10.5 Hardware

- Items bent, twisted, or pulling/pushing out of or into support
- Missing washers and nuts
- Loose washers and nuts on machine bolts (locknuts and spring washers)
- Burns around the bolts
- Crossarm pins out of arms
- Ground wire located near metal parts

## 3.10.6 Grounds

- Ground wires (broken, loose, or missing)
- Proper bonding
- Ground guard/molding intact
- Ground rod driven below ground level

## 3.10.7 Guys and Anchors

- Slack, broken, damaged or rusting guys
- Un-insulated down guys
- Broken or damaged guy strain insulators
- Insulator location (below phase conductors & a minimum of 10-feet above ground)
- Rusting or buried anchor rods (anchor eye exposed)
- Anchors pulling out
- Guy markers (damaged or missing)

## 3.10.8 Right of Way

- Grade changes/excavation within immediate area of transmission line R/W
- Buildings or other encroachments within transmission line R/W
- Flammable material located within R/W (i.e. brush burning, gas storage, ...etc.)
- Physical protection of structures has been compromised
- Any new power or communication lines constructed within Transmission Line R/W
- Forestry concerns:
  - Insufficient tree clearances



## **ATC Preventive Maintenance Plan**


Dead or dying trees or branches that compromise the line (danger trees)

### **3.10.9 General**

- Any sign of unusual activity, such as parties, recreational vehicles, children playing, ...etc.

# ATC Preventive Maintenance Plan

## 3.11 O.H. T-Line Ground Patrol Exception Reporting Form

		Transmission Line "Ground Patrol" Exception Report	
		Line # _____ District _____ From Str. # _____ To Str. # _____	
STR. #	COMMENTS	Rating (1-4)	Date Reported MM/DD/YY
<b>Condition Rating Criteria</b> (1) <b>Fair Condition</b> – Maintenance may not be required. (2) <b>Non-Critical Maintenance Required</b> – Maintenance is completed as time permits, typically completed within one-year. (3) <b>Priority Maintenance Required</b> – Maintenance is completed typically within 90-days. (4) <b>Urgent Maintenance Required</b> – Maintenance process is begun as soon as the problem is reported.		<b>Completed By:</b>  Company: _____ Inspected By: _____ Manhours: _____	

# ATC Preventive Maintenance Plan

## 3.12 Underground T-Line Maintenance/Inspection Plan

### Underground T-Line Inspection Schedule

Underground Transmission Line Inspection Schedule		
Item	Interval	Inspection Forms Documented
U.G. Transmission Line Inspection	Monthly	U.G. Transmission Line Monthly Inspection Report
U.G. Transmission Line Inspection	Annual	U.G. Transmission Line Annual Inspection Report
Manhole Inspection	5-Year	U.G. Transmission Line "Manhole" Inspection Report
Anode Testing	2-Year	U.G. Transmission Line "Anode" Inspection Report
Infrared	Annual	N/A

- 3.12.1 The ATC underground transmission assets include solid dielectric, fluid filled, and gas filled cable systems. Given the congestion of underground facilities located in urban areas, frequent inspections of the lines is necessary to monitor conditions which could result in damage to the cable system.
- 3.12.2 Periodic manhole inspections are necessary to monitor the structural condition of the manhole, inspect splices, and verify the condition of coatings applied for cathodic protection.
- 3.12.3 Anode testing is performed to verify the condition of sacrificial anodes.

### Instruction/Checklists for U.G. T-Line "Monthly" Inspections

- 3.12.4 Underground Transmission Line inspections are completed monthly to verify that the cables, pipes, and electrical devices associated with the line are in good operating condition. "Underground Transmission Line Inspection Forms" are completed and submitted to ATC Maintenance Specialists. The Maintenance Specialists authorize the follow-up work for necessary repairs that were not completed during the inspection.

The following list indicates items to be checked during the underground transmission line inspection.

- 3.12.5 Condition of R/W

## ATC Preventive Maintenance Plan

- New construction/excavation in vicinity of R/W
- Status of previously reported construction/excavation in vicinity of R/W
- Pockets of dead trees, shrubs, grass, ...etc. in vicinity of R/W
- Fluid or Gas Leaks
- Indications of the ground settling or deteriorating in vicinity of R/W
- Manhole covers securely in place
- Adequate "Underground High Voltage Signage/Markers"
  - Underground electric transmission facilities located outside of cities, villages, or developed areas should be marked in a manner recognizable to the public at each road crossing, railroad crossing, or drainage ditch crossing to identify the location of the facility.

### 3.12.6 Visual Inspection of Riser Conditions

- Riser pipes securely in place
- Riser pipes bent or twisted
- Potheads (cracked, discolored, ...etc.)
- Insulators (cracked, discolored, ...etc.)
- Conductors & Hardware should be securely in place

### 3.12.7 Grounds

- Ground wires (broken, loose, or missing)
- Proper bonding
- Ground guard/molding intact
- Ground rod driven below ground level

### 3.12.8 Cathodic Protection System

- Indicator lights functioning properly
- Voltage & current measurements to be obtained with handheld meters
- Check voltage & current gauges vs. measured voltage & current readings to detect any problems with gauges


### 3.12.9 Isolators

- Indicator lights functioning properly
- Loose Connections

### 3.12.10 Fluid or Gas Pressure System

- Pressure of fluid or gas inside pipe to be recorded from gauge
- Heating system working
- Look and Listen for possible fluid or gas leaks
- Verify spare Gas tanks are properly stored on-site for HPGF systems

# ATC Preventive Maintenance Plan

	<b>Underground Transmission Line Inspection Form (Monthly)</b>	
	Line # _____	District _____
	From Str. # _____ or _____	
	Substation	
		To Str. # _____ or _____
		Substation
<b>Type of Underground Cable System</b>		
<input type="checkbox"/> High Pressure Fluid Filled <input type="checkbox"/> Low Pressure Fluid Filled <input type="checkbox"/> Solid Dielectric <input type="checkbox"/> Medium Pressure Fluid Filled <input type="checkbox"/> High Pressure Gas Filled		
<b>Condition of R/W (Entire Length of Line)</b>		
OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No    Comment: _____		Rating <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div>
<b>(Point of Beginning) Str. # _____ or _____ Substation</b>		
<b>Visual Inspection of Riser Conditions</b>		<b>Fluid or Gas Pressure</b>
OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No    Rating <div style="border: 1px solid black; width: 30px; height: 30px; display: inline-block;"></div>		OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A    Pressure _____ Rating <div style="border: 1px solid black; width: 30px; height: 30px; display: inline-block;"></div>
<b>Cathodic Protection System</b>		<b>Isolator</b>
OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A    Voltage Output _____ Amps Output _____ Rating <div style="border: 1px solid black; width: 30px; height: 30px; display: inline-block;"></div>		OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A    Pressure _____ Rating <div style="border: 1px solid black; width: 30px; height: 30px; display: inline-block;"></div>
Comments: _____		
_____		
_____		
<b>(Ending Point) Str. # _____ or _____ Substation</b>		
<b>Visual Inspection of Riser Conditions</b>		<b>Fluid or Gas Pressure</b>
OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No    Rating <div style="border: 1px solid black; width: 30px; height: 30px; display: inline-block;"></div>		OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A    Pressure _____ Rating <div style="border: 1px solid black; width: 30px; height: 30px; display: inline-block;"></div>
<b>Cathodic Protection System</b>		<b>Isolator</b>
OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A    Voltage Output _____ Amps Output _____ Rating <div style="border: 1px solid black; width: 30px; height: 30px; display: inline-block;"></div>		OK _____ <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A    Pressure _____ Rating <div style="border: 1px solid black; width: 30px; height: 30px; display: inline-block;"></div>
Comments: _____		
_____		
_____		

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CONDITION RATING CRITERIA	COMPLETED BY:
(1) <b>Fair Condition</b> – Maintenance may not be required.	<b>Company:</b> _____
(2) <b>Non-Critical Maintenance Required</b> – Maintenance is completed as time permits, typically completed within one year.	<b>Inspected By:</b> _____
(3) <b>Priority Maintenance Required</b> – Maintenance is completed typically within 90 days.	<b>Date:</b> _____
(4) <b>Urgent Maintenance Required</b> – Maintenance process is begun as soon as they problem is reported.	

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## Underground T-Line "Manhole" Inspection

- 3.12.11 Manhole inspections are completed on a five (5)-year cycle to ensure the structural integrity of the manhole, as well as to verify that the cables, pipes, and electrical devices located within the manholes are in good operating condition. "Manhole Inspection Forms" are completed and submitted to ATC Maintenance Specialists. The Maintenance Specialists authorize the follow-up work for necessary repairs that were not completed during the inspection.

The following list indicates items to be checked during a manhole inspection.

### 3.12.12 Structural Integrity of Manhole

- Roof, walls, floor, & chimney deteriorating/cracking
- Manhole ring & cover securely in place
- Ladder securely in place

### 3.12.13 Pipe/Cable

- Pipe condition/corrosion
- Pipe coating condition
- Valves leaking/deteriorating/corroding
- Visual inspection of cable (check condition of insulation)

### 3.12.14 Cathodic Protection Equipment

- ??
- ??

### 3.12.15 General

- Dirty water
- Gas detection
- Manhole cleaned

# ATC Preventive Maintenance Plan

## 3.13 Substation Inspection Plan

### 3.13.1 Introduction

3.13.1.1 The ATC has 97 ATC only substations and 359 joint substations. The order in PSCW docket no. 05-EI-119 prescribed that, at joint sites, the utility with the most investment at a site is owner of the common facilities. The common facilities are those assets that benefit all site occupants. The “predominant utility” is the owner of the common facilities. The ATC is the predominant utility at 65 of the joint sites and is therefore responsible for the maintenance of the common equipment. At 294 joint sites, the local distribution company is the predominant utility. Cost of maintaining the common equipment is shared on a pro rata basis upon relative investment.

Substation Inspections	ATC Required Interval
Substation Inspection	Monthly
Infrared Inspection	Annually
Safety Equipment	Annually

3.13.1.2 Substation inspections are performed as indicated in the above schedule. Many components of the substation are monitored continuously through energy management system. The purpose of the substation inspection is to verify that the site is secure, detect any developing equipment deficiencies, and correct them before they impact the operation of the system.


3.13.1.3 Infrared inspections are performed to detect deficiencies in disconnect switches, conductors, connections, circuit breakers, power transformers, instrument transformers and any other pertinent equipment. These inspections detect possible equipment deficiencies that are not visible from normal inspections.

3.13.1.4 Safety inspections are required by OSHA to ensure the integrity of the ground jumpers and other site safety equipment.



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## 3.13.2 ATC Monthly Substation Inspection Form

Substation Inspection Report		Substation Name: _____	
		Inspector's Name: _____	
		Date: _____	
		Time: _____	
		Temperature: _____	
Item #	Fence, Grounds, Structures	Rating	Comments
1	Perimeter fence intact, no accessible openings		
2	Gates locked securely		
3	Signs posted properly		
4	Weeds controlled		
5	Landscaping & Shrubs, Trees, Grass		
6	Washouts, Erosion - Driveway & Site		
7	Driveways, Culverts		
8	Foundations		
9	Yard Lights & Posts - Test Lights		
10	Ground Wires		
11	Conduit & Fittings		
12	Underground Cable / Trench Covers		
13	Paint		
14	Lightning Mast and shield wires		
15	Oil Leaks - Explain in Comments		
Item #	Control House	Rating	Comments
16	Building, Appearance, Inside/Outside		
17	Heat, Ventilators, Air Cond., Temperature		
18	Fire extinguisher		
19	First aid / Burn kit / Eye wash		
20	Medical Emergency Procedure form		
21	Switching tools - If applicable		
22	Battery, Rack & Area		
23	Switchboard Lights		
24	Spare Switchboard Fuses & Lights		
25	Relay Targets - Record under Remarks, Reset		
26	A.C. & D.C. Lights		
27	Door Operation (Inc. Panic Hdwr.) / Locks		
28	Sump pit pumps and drains		
29	Adequate rodent abatement		
30	Telephone - Check for dial tone		

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31	Switch designation diagram posted		
32	Emergency Contact list posted		
	<b>Bus Work, Switches, T-Line Termination</b>	<b>Rating</b>	<b>Comments</b>
33	S&C Circuit Switchers, Heaters in cabinets		
34	S&C Circuit Switchers, Loss of gas targets		
35	S&C Circuit Switchers, number of operations		No. of Ops. =
36	Switch Motor Operators		
37	Switch Motor Operator Cabinets – Heaters on		
38	Switches - Contacts Fully Closed		
39	Switch Locks & Signs		
40	Insulators, Bus Supports		
41	Arresters, VT's, PT's, PD's, CT's, CCVT's, Coupling Capacitors		
42	Potheads & Cables		
43	Leads & Connections		
	<b>Capacitor Banks</b>	<b>Rating</b>	<b>Comments</b>
44	Blown Fuses		
45	Bulged or Leaking Cans		
46	Warning Signs		
	<b>Accessories</b>	<b>Rating</b>	<b>Comments</b>
47	Cabinets & Boxes, ID Tags		
48	Switch Sticks & Boxes		
	<b>Transformers</b>	<b>Rating</b>	<b>Comments</b>
49	Main Tank Pressure (+, -, 0)		
50	Nitrogen Tank Pressure - Lbs.		Change if it is below 200#'s
51	Check Conservator Tank		
52	Fans, Pumps (X if on)		
53	Temperature (Reset if over 70) Record Drag Hand Ind.		Drag hand Indicator =
54	Oil Level (L if low) Record oil level Indicator reading		Oil Level =
55	Gauges (B if broken)		
56	Oil Leaks - (S-Serious, M-Minor)		
57	Bushings - Oil Level (L if low)		Oil Level =
58	- Defective (D)		
	LTC's - Record range of operation - Reset drag hands		Range of Operation =
59	Oil filtration system - Run Time =		
60	- Pressure =		
	- Check Desiccant, replace if needed		
	Check Controls - In auto (note if tagged and in manual)		

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61	Paint – check for chipping, fading, rust		
62	Foundations		
63	Oil Spill Containment- Inspect and Pump if needed		
<b>Item #</b>	<b>OCB, VCB, GCB</b>	<b>Rating</b>	<b>Comments</b>
64	Air Operator, Oil or Pressure – Lbs. Gas		Gas Pressure =
65	Operation Counter Reading (Record & Update Card)		Ops. Counter =
66	Heaters (On-Off)		
67	Cabinet Interior (X needs attention)		
68	Bushings - Oil Level (L if low)		
69	- Defective (D)		
	Air receivers - (Drain moisture during Summer)		
	Annunciators - operate properly (345kV breakers)		
70			
71	Paint – check for chipping, fading, rust		
72	Foundations		
	Compressor Hour Rdg. (Record Hours) / Reset timers		Comp. Hour Rdg.=
73			
74	Check Compressor belts and oil level		
<b>Item #</b>	<b>Additional Comments:</b>		
	<b>Condition Rating Criteria:</b>		
	This condition rating listed below, reports by exception for any required maintenance and establishes the condition of a facility and also determines the repair schedule to correct deficiencies.		
	Leave the Rating column blank for the Items that found to be in Good condition.		
	<b>1 = Fair condition, maintenance is not required.</b>		
	<b>2 = Non-critical maintenance required - normally repaired within 12 months.</b>		
	<b>3 = Priority maintenance required - normally repaired in 90 days.</b>		
	<b>4 = Urgent maintenance required - report immediately to the utility and repair as soon as possible.</b>		

### 3.13.2.1 Fence, Grounds, Structures

- 1-3. Fence, Gates, Locks, Signs
- ✓ Check that barbed wire is intact
  - ✓ Are "High Voltage" signs present on fence and gates (minimum 60 ft. Intervals)?
  - ✓ Do entrance gates operate properly?

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- ✓ Is the yard grade within 4" of fence fabric?
- ✓ Are fence grounds intact, including gate grounds?
- ✓ Are locks working properly?
- 4. Weeds
  - ✓ Note over abundance of weeds (June through September)
- 5. Landscaping and Shrubs
  - ✓ Check for dead or dying trees or shrubs
  - ✓ Pick up trash in and around substation including outside of fence and driveway
  - ✓ Observe grass height – arrange for cutting if needed
- 6. Erosion, Driveway and Site, Washouts
  - ✓ Fill in or barricade, as needed
  - ✓ Determine if a washout is a safety hazard (fill in or barricade)
- 7. Driveway Culverts
  - ✓ Ensure that culverts are open
  - ✓ Remove debris from culvert
- 8. Foundations
  - ✓ Observe for cracks and checking
  - ✓ Observe for eroding and abnormal concrete
- 9. Yard Lights and Light Standards
  - ✓ Observe the condition of the light standards
  - ✓ Observe concrete light standards for cracking
  - ✓ Do the yard lights need adjustment?
  - ✓ Ensure all lights work
- 10. Ground Wires
  - ✓ Verify that the structure and equipment grounds are intact
  - ✓ Note ground grid wire or ground rods protruding from gravel, and barricade tripping hazards
- 11. Conduit and Fittings, Secondary Junction Boxes
  - ✓ Are conduit fitting covers are present?
  - ✓ Open yard secondary junction boxes and inspect for water leakage
  - ✓ Are conduit straps in place?
  - ✓ Is there rust present?
  - ✓ Are ID tags present legible?
- 12. Underground Cable / Trench Covers
  - ✓ Observe outdoor equipment control cabinet and cable entrances for excessive control cable tension

## ATC Preventive Maintenance Plan

- ✓ Observe that the trench covers are in place and not broken
- 13. Paint
  - ✓ Observe equipment and structure for rust and areas that need touch up painting
  - ✓ Note if paint is chipped and/or badly faded
- 14. Lightning Mast
  - ✓ Are masts securely grounded?
  - ✓ Do the masts appear plumb?
- 15. Oil Leaks
  - ✓ Indicate all oil leak areas
  - ✓ Contact appropriate personnel if the oil leak is serious
    - ✓ Serious = wet and puddles
    - ✓ Minor = dry to slightly wet

### 3.13.2.2 Control House

- 16. Building, Appearance, Inside/Outside
  - ✓ Observe signs of water leaks
  - ✓ Observe signs of rodents
    - ✓ In Main Terminal Cabinet
    - ✓ In Control Cable Tray
  - ✓ Indicate if floors need scrubbing or painting
  - ✓ Note that Substation Inspection Report form and System Disturbance Report forms are present
  - ✓ Observe for wasp nests
  - ✓ Record obvious repairs needed including cable entrance sheds
  - ✓ Sweep the floor
  - ✓ Empty the waste basket
  - ✓ Note if switch designation diagram is posted and legible
  - ✓ Note if emergency contact list is posted and legible
- 17. Heat, Ventilators, Air Conditioning, Temperature
  - ✓ Check that the Control House temperature is normal
    - ✓ Thermostats are set at 65 for heating, 75 for cooling
    - ✓ Note any high or low temps and possible equipment or thermostat problems
- 18. Fire Extinguisher
  - ✓ Note pressure and most recent inspection date on card – (if applicable)
  - ✓ Note extinguisher type
- 19. First Aid, Burn kit, Eye-wash

## ATC Preventive Maintenance Plan

- ✓ Check that there are adequate supplies in these safety stations – (if applicable)
- 20. Medical Emergency Procedure form
  - ✓ Check that there is an adequate supply of forms – (if applicable)
- 21. Switching tools
  - ✓ Check the condition of switch sticks
  - ✓ Note test date
- 22. Battery, Rack & Area
  - ✓ Observe for signs of battery cell electrolyte leak
  - ✓ Indicate if battery terminals are corroded
  - ✓ Indicate if corrosion is on walls or floor
  - ✓ Check the Eye Wash Station solution for expiration date
  - ✓ Observe that Warning Signs are present
- 23. Switchboard Lights
  - ✓ Appropriate lamps are lit
- 24. Spare Switchboard Fuses and Lights
  - ✓ Verify that the fuse and lens puller tools are present
  - ✓ Verify that there are spare lamps in file cabinet
  - ✓ Verify that there are spare fuses in file cabinet
  - ✓ Verify that Protective Cards are present
  - ✓ Note what is needed, ensure it is ordered
- 25. Relay Targets, Record Under Remarks, Reset Targets after contacting and informing system control center.
  - ✓ Report both relay targets and annunciator alarms to appropriate Sys. Control Center
- 26. AC & DC Lights
  - ✓ Verify that all lights work, indoor and outdoor
  - ✓ Get familiar with location of lighting switches
  - ✓ Verify that the DC light works
- 27. Door Operation (Including Panic Bar and Hardware)
  - ✓ Verify that Emergency Exit door (panic door) operates normally
  - ✓ Verify that Entrance door operates normally
  - ✓ Verify that the door stop is operable
  - ✓ Verify that the door locks are operable
  - ✓ Observe that the EXIT signs are on inside of doors
- 28. Sump pit pumps and drains
  - ✓ Check that the sump pump operates and that the drain is clear

## ATC Preventive Maintenance Plan

- 29. Adequate rodent abatement
  - ✓ Check traps and trays
  - ✓ Note any evidence of rodents or other animals
- 30. Telephone
  - ✓ Are local emergency and personnel contact numbers posted, correct, legible?
  - ✓ Are indoor and outdoor ringers operable (have local center call back)?
  - ✓ Is substation address and fire # present?
- 31. Switch designation diagram posted
  - ✓ Check that this diagram is legible and not in need of replacement
- 32. Emergency contact list is posted
  - ✓ Ensure that this list is posted and is legible, contact ATC if it need replacement

### 3.13.2.3 Bus Work, Switches, Transmission Line Terminations

#### 33-35 S&C Circuit Switchers

- ✓ Observe the circuit switcher position. If closed, then blades should be flat in jaw.
- ✓ Observe for low gas indication at rear of interrupter bottle or bottom of Interrupter column. If a target is present, notify Maintenance and System Operating immediately
- ✓ Observe condition of control cabinet (i.e., heaters, water leaks, door gasket, coupling etc.)

#### 36,37 Switch Motor Operators

- ✓ Verify that operating swing handle or crank is present
- ✓ Are heaters ON (should remain on all year)?
- ✓ Observe door seal condition
- ✓ Observe that the de-coupling instructions are in the Substation Operating Procedure Book

#### 38. Switches

- ✓ Observe switches are closed correctly
- ✓ Observe switch insulators for damage
- ✓ Observe that conductors from the switch to equipment are not excessively tight
- ✓ Observe that switch attachments are in proper operating position (i.e., whips, interrupters, etc.)
- ✓ Note abnormal findings

#### 39. Switch Locks and Signs

## ATC Preventive Maintenance Plan

- ✓ Are switch locks present and serviceable?
  - ✓ Are switch signs present and legible?
  - ✓ Does grade need to be raised at switch operating mechanism locations to avoid standing in water or on ice when operating a switch?
40. Insulators (Bus Support)
- ✓ Visually inspect insulators for flash marks, cracks, chips
- CAUTION: Maintain working clearances**
41. Arresters, Current and Potential Transformers, CCVT's, and coupling capacitors
- ✓ Observe bushings for flash marks, cracks, chips
  - ✓ Observe CT & PT bushing for oil leaks and oil levels
  - ✓ Observe condition of junction boxes (i.e., water leaks, door gaskets, etc.)
  - ✓ Observe condition of fuses
  - ✓ Are ID tags present and legible?
42. Potheads, Power Cables
- ✓ Observe for signs of dielectric compound leakage
  - ✓ Visually inspect terminations for excessive tension
  - ✓ Visually inspect terminators for weather checking
43. Leads and Connections
- ✓ Observe all leads for excessive tension and electrical clearance
  - ✓ Observe for broken wire strands
  - ✓ Observe all connector bolts are present
  - ✓ Observe expansion joints for binding or over-extension
  - ✓ Observe transmission line dead end structures and line pull-offs

### 3.13.2.4 Capacitor Banks

44. Observe for blown capacitor fuses
45. Observe for bulged or leaking capacitors
46. Observe condition of Danger Signs
- ✓ Verify that Danger HV signs are present on all four sides of each phase structure

### 3.13.2.5 Accessories

47. Cabinets, Junction Boxes, ID Tags
- ✓ Are cabinet and junction box ID tags present and legible?
  - ✓ Observe all control cabinets and junction boxes for signs of water leakage



# ATC Preventive Maintenance Plan

- ✓ Observe the condition of door gaskets

## 48. Switch Sticks & Storage Boxes

- ✓ Observe the condition of switch sticks, record test date
- ✓ Observe the condition of the switch stick storage device
- ✓ Observe box for signs of water leakage

### 3.13.2.6 Transformers

## 49. Main Tank Pressure (+, -, 0)

- ✓ Normal pressure is 0.5 to 5 lbs. PSI (positive)
- ✓ Note pressure if out of range
- ✓ Immediately report negative pressure to appropriate personnel
- ✓ Identify the sudden pressure device and check for a target flag
- ✓ Do not operate (reset) the sudden pressure reset switch in the control cabinet

## 50. Nitrogen Tank Pressure

- ✓ Note nitrogen tank pressure (PSI)
- ✓ Immediately contact appropriate personnel if below 200 PSI
- ✓ Observe condition of cabinet, clean if needed

## 51. Conservator Tanks

- ✓ Conservator level adequate
- ✓ Gas accumulation indicator ok

## 52. Fans, Pumps

- ✓ Indicate if fans and pumps are running
- ✓ Fan and pump controls are normally in "Automatic" position
- ✓ Remove bird nests and debris from cooling fans
- ✓ Observe condition of control cabinet
- ✓ Test operate fans and pumps during spring inspection
- ✓ Note that the heaters ON

## 53. Temperature – Transformer Oil

- ✓ Record top oil temperature
- ✓ Record temperature gauge drag hand positions
- ✓ Reset drag hands if above 70°C
- ✓ FYI –
  - ✓ Formulas:
    - Celsius to Fahrenheit =  $(\text{Celsius} \times 9/5) + 32$
    - Fahrenheit to Celsius =  $(\text{Fahrenheit} - 32) \times 5/9$
- ✓ Verify that fans and pumps control are in the "Auto" position
  - ✓ Top oil gauge
    - 1st stage fans @ 60°C
    - 2nd stage fans and pumps @ 65°C

## ATC Preventive Maintenance Plan

- Alarm @ 90°C
  - ✓ Winding temperature gauge setting
    - 1st stage fans @ 70°C
    - 2nd stage fans and pumps @ 75°C
    - Alarm @ 115°C
- (Contact appropriate personnel if excessively hot)

54. Oil Level
  - ✓ Indicate if oil level is low
  - ✓ Oil level is normally higher in summer and lower in winter
  - ✓ Indicate if control cabinet has oil or water leak
55. Gauges
  - ✓ Indicate if broken or damaged
  - ✓ Indicate drag hand position
  - ✓ Reset drag hands if 70°C or higher
56. Oil Leaks
  - ✓ Indicate oil leak area
  - ✓ Contact appropriate personnel if Serious
    - Serious = wet and puddles
    - Minor = dry to slightly wet
57. Bushings (**CAUTION: Maintain working clearances**)
  - ✓ Observe bushing oil level and color, indicate if low and/or oil color is dark (brown)
  - ✓ Visually inspect the condition of bushings
    - ✓ Cracks or chips in porcelain
    - ✓ Contamination on porcelain
    - ✓ Flash marks
    - ✓ Oil Leaks
58. ULTC's Transformers
  - ✓ Record the range of operation and reset the drag hands
59. ULTC Oil filtration system
  - ✓ Record the run time
  - ✓ Record the pressure
  - ✓ Check the desiccant, replace if needed
  - ✓ Check for oil leaks
60. Check the controls
  - ✓ Control is normally in the Auto position, if not it should be tagged for manual
61. Paint

## ATC Preventive Maintenance Plan

- ✓ Record if paint is chipping, peeling, rusting on tank, radiators, etc.

62. Foundations

- ✓ Observe concrete for deterioration, cracks, out of plumb

63. Oil spill containment

- ✓ Ensure the containment area is secure
- ✓ Clean up or pump oil if necessary

### 3.13.2.7 OCB, VCB, GCB

64. Operator, Oil or Air Pressure

- ✓ Normal operating pressure is indicated on the gauge or cabinet door
- ✓ Indicate the gauge pressures if out of range
- ✓ Verify that "Open" and "Close" position indicators are present and legible
- ✓ Listen for audible air leaks on air operators

65. Operation Counter Reading

- ✓ Record operation counter reading
- ✓ Update the counter card, if needed

66. Heaters

- ✓ Indicate that heaters are "On" or "Off".

67. Cabinet Interior

- ✓ Indicate if cabinet needs attention (cleaning or repair)
- ✓ Observe for oil, air, or water leaks

68. Bushings

- ✓ Observe bushing oil level, gauge or glass globe
- ✓ Indicate if oil level is low
- ✓ Contact appropriate personnel if oil level is off scale (low or high)

69. Air Receivers

- ✓ Drain moisture in the summer

70. Annunciators

- ✓ Ensure proper operation (345kV Breakers)

71. Paint

- ✓ Indicate if paint is chipping, peeling, or badly faded

72. Foundations

- ✓ Observe concrete for deterioration, cracks, out of plumb

## ATC Preventive Maintenance Plan

73. Compressor Run Time Hour Reading
  - ✓ Indicate compressor hour reading
  - ✓ Update the compressor hour operation card
74. Oil Level/Leaks
  - ✓ Observe tank oil level gauge, indicate if low
  - ✓ Indicate location of oil leak
  - ✓ Temperature of the oil tank should be ambient temperature
  - ✓ Immediately contact appropriate personnel if the tank is hot

### 3.13.3 Substation Equipment Preventive Maintenance Tasks

A significant percentage of the overall budget is expended performing Preventive maintenance tasks. The tasks and frequencies for each of these activities are listed below.

Substation Preventive Maintenance	ATC Required Interval
<b>Battery Maintenance – Terminal Cleaning</b>	Annually
– Specific Gravity Measurements	Annually
– Impedance Testing	Annually
– Check Electrolyte Levels	Annually
<b>Battery Replacements</b>	20 Years
<b>Circuit Switcher – Major Inspection</b>	5 Years or 1250 Operations 8 or 10 Years (Coordinate with Transformer Maintenance)
– Vacuum Bottle Change Out	5000 Operations
<b>Circuit Breaker – Compressor Checks</b>	Annually
– Mechanism Pre-Charge	Annually
– Winterization	Annually
<b>Gas Breaker – % SF6</b>	Performed at Commissioning
– SF6 Moisture Test	Performed at Commissioning
– Diagnostic Tests	6 Years
– Major Inspection	Based on Test Results or 30 Fault Operations
– Mechanism Lube and Inspect	6 Years
<b>Oil Breaker – Diagnostic Tests</b>	6 Years
– Oil Quality Tests	4 Years > 200KV 6 Years < 200KV
– Major Inspection	12 Years or 30 Fault Operations
– Mechanism Lube and Inspect	6 Years
<b>Substation Weatherize – Summer</b>	Annually
– Winter	Annually
<b>Substation HVAC – Inspect Filter</b>	Annually
<b>Transformer – Cooling System Control Test, Lube, Inspect</b>	5 Years

## ATC Preventive Maintenance Plan

– Oil Dissolved Gas Analysis (DGA)	Annually < 200KV Semi-Annually > 200KV
– Dielectric – Chemical Analysis	Annually < 200KV Semi-Annually > 200KV
– Oil Pump Bearing Test	Annually
– Radiator Power Wash	As Needed
– LTC Exercise	Test Results and # of Operations

SCADA Preventive Maintenance	ATC recommended Interval
HMI – Clean Hard Drive	6 Months
Transducer Calibration	As Needed
Fault Recorder – Operation Test	Annual

Relay Testing	ATC recommended Interval
Relay Testing – Electromechanical	4 Years
Communication Checks	Annually
Relay Testing Microprocessor	8 Years
Relay Testing – Lockouts	4 Years

### 3.13.3.1 Battery Maintenance

Normal Cell Voltage and Specific Gravity Readings (at 77 degrees F)  
Cell Acceptance Criteria

Type of Measurement	Good	Watch	Probable Low Cap	Danger	Failed
Impedance (MBITE)	0 – 10%	10 – 25%	25 – 50%	50 – 80%	>80%
Resistance (Cellcorder)	0 – 10%	10 – 25%	25 – 50%	50 – 80%	>80%

Normal Cell Voltage and Specific Gravity Readings (at 77 degrees F)

	Specific Gravity	Float Voltage	Equalize Voltage
Lead Antimony	1.210 – 1.220	2.15 – 2.17	2.28*
Lead Calcium	1.200 – 1.220	2.20 – 2.25	2.33*

Note: \* Presumes a 72 hour equalize time.


# ATC Preventive Maintenance Plan

Test Equipment - It is important to recognize that future tests will need to be done with same manufacturer and model of test equipment to determine a battery capacity pattern. There are differences in the devices and how they measure the ohms value.


Acceptable test equipment includes the following:

- Impedance – AVO Biddle MBITE
- Resistance – Albercorp Cellcorder

## Test Specification

 Determine a “nominal value” of ohmic resistance for a 100% capacity battery cell by determining an average for the existing cells. Measurements should be taken and recorded on the attached form and calculation sheet. Nominal values should be expected to be in the following ranges...

- Less than 0.2 milliohms for a large cell
- Over 1.0 milliohms for a smaller cell
- Over 2.0 milliohms for a small 6-volt to 12-volt modular cell

 Once the adjusted average cell value is determined, the following chart may be used to determine a cell's health.

- Cells in the “Probable Low Capacity” and “Danger” category should be changed at the earliest convenience.
- Cells in the “Failed” category should be checked to ensure there is not an open circuit. The cell voltage shall be above 2.08 volts. The specific gravity of the cell shall be above the minimums listed below. Cells in the “Failed” category not meeting these requirements shall be removed from service immediately by jumpering out the cell and adjusting the charger voltage.

Schedule - Annual

### 3.13.3.2 Circuit Breaker Maintenance

Scope The scope of this document is to cover the minimum required maintenance to be performed on ATC Circuit Breakers.

Frequency:

- Monthly Inspection.
- Yearly Winterizing and Lubrication (including compressor if applicable).
- Four year oil dielectric test to be performed on Oil Circuit Breakers > 200 KV.
- Six year oil dielectric test to be performed on Oil Circuit Breakers < 200 KV.
- Six year Test Schedule on Circuit Breaker.

# ATC Preventive Maintenance Plan

- Twelve year test and major inspection.

Exceptions to this guideline would be:

- Circuit Breakers at Nuclear Plant Substations where Testing and Major Inspections are on a more rigorous schedule.
- Circuit Breakers major inspections would also be performed sooner if the test results at the four or six-year interval indicated deterioration in the circuit breakers condition.
- Gas Circuit Breakers would have testing performed every six years or 30 fault operations. The results of the testing would determine when the major inspection would be performed. A major inspection on an SF6 gas circuit breaker will be based on test results and fault operations.
- Oil Circuit Breakers > 200 KV will be on a 44-year test schedule
- Oil Circuit Breakers < 200 KV will be on a 6-year test schedule

The maintenance schedules set forth were determined by information gathering from the founding utilities maintenance schedules and also Doble clients and their test frequencies.

The required maintenance to be performed was gathered from Manufacturers Instruction Books.

## Minimum Required Maintenance:

- All breakers to be inspected monthly for:
  - ✓ Leaks (oil, air and gas)
  - ✓ External Damage to Circuit Breaker
  - ✓ Inspection of control Cabinets
  - ✓ Recording of Run hour meter, operations counter and pressure gauges
  - ✓ External condition of breaker (paint, foundation, and electrical connections)
- All breakers to be inspected annually for winter conditions inspections will include:
  - ✓ All monthly inspections
  - ✓ Heater inspection
  - ✓ Lubrication of mechanism
  - ✓ Inspection and maintenance of operating system (hydraulic, spring and air)
  - ✓ All circuit breakers are to be opened and closed locally and remotely once per year. A relay operation of opening and closing due to storm will be considered a completion of this maintenance requirement.

## ATC Preventive Maintenance Plan

- All circuit breakers greater than 200 KV will have an oil dielectric test performed every four years.
- All Circuit Breakers will be tested every 4 or 6 ~~Four or Six~~ years depending on voltage class. The testing will include:
  - ✓ Power Factor Test
  - ✓ Micro-Ohm Test Contact Resistance – 10 amp or 100 amp
  - ✓ Motion Test Speed Test
  - ✓ Oil or Gas Test - gas test is performed only at commissioning and when gas has been added
  - ✓ Calibration of gauges I caution against touching the pressure switches
  - ✓ Open and close operation locally and remotely
  - ✓ Operations check to lockout
  - ✓ Inspection and lubrication of mechanism
  - ✓ Inspection and maintenance of operating medium system

Note: Test results may change the test frequency to a more rigorous schedule due to deterioration of the circuit breaker.

- All Circuit Breakers will have a major inspection every twelve years or thirty operations which ever comes first.
- Major inspection to include:
  - ✓ All the test and inspections performed on the six-year test.
  - ✓ Inspection of all internal components listed in instruction Book provided by Manufacturer for the specific type of Circuit Breaker.

### 3.13.3.3 Breaker Testing

Scope The scope of this document is to state the recommended tests to be performed on circuit breakers. The test results will be used to evaluate the condition of the circuit breaker and provide the needed information as to the need of a major inspection to the circuit breaker. Tests required on a circuit breaker will be a power factor test, breaker-timing test, micro-ohm test, oil test, verification of pressure switches, pressure gauges, a general maintenance of the control cabinet and a general inspection of the circuit breaker.

#### Test Equipment

- Power Factor Test Set
- Breaker timing Test Set
- Micro- Ohm Test Set 10 amp or 100 amp
- Oil Dielectric Tester



# ATC Preventive Maintenance Plan

- Calibration Gauge
- SF6 gas test sets

## Testing information

- Refer to manufactures instruction book for acceptable limits for:
  - ✓ Breaker timing test results
  - ✓ Micro-ohm test results
  - ✓ SF6 gas sampling
- Refer to Doble test data for power factor test results. (Unless you have a comparable database). Dielectric oil testing will follow IEEE standard

## Oil Circuit Breaker Testing See WE Document 10-251 for Specs for Oil for Continued Service, Oil Requiring Reclamation and Oil Requiring disposal

- Verify Circuit breaker is isolated properly
- Perform power factor test
- Perform breaker-timing test
- Perform micro-ohm test 10 amp or 100 amp?
- Perform oil test
- Perform pressure switches and gauge calibrations
- Perform external breaker inspection
  - ✓ Inspect bushings, gas leaks, paint, foundation, high voltage leads, grounds, and other external components
- Perform breaker cabinet inspection
  - ✓ Inspect heaters, wiring, knife switches, fuses, and operating system, (air, hydraulic, spring or solenoid) if moisture is present and other internal components.
- After all testing and inspecting is completed verify operation of breaker by local controls and remote controls.

## Gas Circuit Breaker Testing

- Verify Circuit breaker is isolated properly
- Perform breaker-timing test
- Perform SF6 Gas sample test when gas has been added
  - ✓ Dew point test
  - ✓ Purity Test
- Perform micro-ohm test
- Perform external breaker inspection
  - ✓ Inspect bushings, gas leaks, paint, foundation, high voltage leads, grounds, and other external components
- Perform breaker cabinet inspection
  - ✓ Inspect heaters, wiring, knife switches, fuses, and operating system, (air, hydraulic, spring or solenoid) if moisture is present and other internal components.

## ATC Preventive Maintenance Plan

- After all testing and inspecting is completed verify operation of breaker by local controls and remote controls.

### References Materials

- Circuit breaker instruction book
- Substation electrical prints
- Test equipment manuals

### Test and Inspection Results

- All test and inspection results will be sent to the appropriate ATC Substation Maintenance Specialist. If any defects are found, repairs should be made to the breaker before it is returned to service. If test results are unacceptable and the breaker cannot be returned to service, contact an ATC Substation Maintenance Specialist as soon as possible. Test results, which are questionable, but the breaker can be returned to service shall be so noted in the write up and forwarded to ATC Substation Maintenance Specialist for follow-up.

### 3.13.3.4 Breaker Winterizing and Lubrication

Scope The following is a guideline to identify how to winterize and annual Preventive maintenance on air- and pneudraulic-operated oil circuit breakers. This will help to prevent breaker-related customer service problems by ensuring that the breaker is operating properly, and moisture is not causing damage or faulty operation of the breaker. It is important that as much moisture as possible be drained from air-operated systems. Heating systems must be in good working condition to prevent moisture problems.


Winterizing Breakers - Frequency will be yearly and in the fall of the year.

References - Breaker Manufacturer's Instruction Book & Substation Prints




If the unit is pneumatically operated, do the following:

- If the Circuit Breakers air tanks have a registration tag on it from the State of Wisconsin. Then you need to verify the operation of the air over pressure relief valve. Record and document yearly for State Inspector.

- NOTES:

 Excessive for pneumatic system is greater than five hours per week. Excessive for pneudraulic system is greater than three hours per week.

## ATC Preventive Maintenance Plan

-  Use a non-corrosive leak detector solution around the fittings; the check valve connection; and the control check and pressure relief valves to locate leaks.
-  A leak detection solution will not uncover leaky check valves. To determine if there is a leak through the check valve, feel for escaping air, or disassemble the valve.
-  For Pneudraulic-operated units, listen for leaks, and look for evidence of the red hydraulic fluid to locate leaks. The oil sump may have to be lowered to expose all hydraulic parts.

Verify SF6 gas pressure, use manufactures instruction book for proper operating pressures (If applicable).

### 3.13.3.5 Maintenance Practices of Power Transformers

- Based on the information gathered from the benchmarking studies and the past practices of the contributing utilities, the following maintenance for power transformers is recommended. Infrared scanning of transformers should continue to be done at one-year intervals. The dissolved gas analysis (DGA) test provides more reliable results. The DGA testing should be done at one-year intervals with exceptions as needed. Oil moisture and dielectric strength tests should also be done on a yearly basis. Acid content and color should be done on a four-year cycle.— See WE Document 10-251 for oil classification values. The power factor of the oil will be timed to correspond with the Doble testing of the transformer (4 or 5 years).
- Transformer offline testing should be done every four years for voltages above 200 kV and every five years for voltages below 200 kV. The testing should consist of Doble power factor, Doble excitation, and for transformers with a load tap changer, a contact resistance test.
- The load tap changer maintenance includes; gas in oil, partial discharge, oil dielectric and color, infrared, partial discharge, time, and number of operations. Tap changers are of a multitude of designs and types, which results in difficulty in developing a common maintenance program for all types. It is recommended that each utility continue its present maintenance practices on LTC's while more information is gathered to develop a comprehensive plan for all of the different types of LTC's on the system.

## ATC Preventive Maintenance Plan

- Use of on line oil filtering of LTC's should be continued and added to units that do not already have a filter. Experience has shown that contact wear is reduced and maintenance cycles can be extended.
- A chart comparing present maintenance practices along with those proposed above follows.
- Partial discharge testing and vibration analysis is currently only being done by Alliant Energy. It needs to be looked at more closely and may have application across the rest of the ATC system. In the mean time, Alliant should continue to do this testing as it has done in the past.

Maintenance Task		6 months	1 year	4 years	5 years
Infrared Scan (IR)			X		
Partial Discharge (PD)			X**		
Vibration pumps & wdgs			X**		
Load tap changer inspection*					
Oil Tests	Moisture	>200kV	<200kV		
	Dielectric (ASTM D1816)	>200kV	<200kV		
	Acid (ASTM D974)			X	
	Color (ASTM D1500)			X	
	Interfacial Tension (ASTM D971)			X	
	DGA	>200kV			
	DGA		<200kV		
Electrical Tests	Power Factor (oil, windings, and bushings)			>200kV	<200kV
	Excitation			>200kV	<200kV
	Winding Resistance – LTC Xfmr's only			>200kV	<200kV

Notes: \* Load tap changer maintenance should continue to be done at the present LDC cycles.

\*\* Partial discharge testing and vibration analysis is currently only being done by Alliant Energy. It needs to be looked at more closely and may have application across the rest of the ATC system. In the mean time, Alliant should continue to do this testing as it has done in the past.

# **ATC Preventive Maintenance Plan**

## **3.14 ATC Budget and Cost Management**

### **3.14.1 General**

- 3.14.1.1 The ATC's Maintenance Specialists work closely with the maintenance supervision of the local distribution companies (LDC's). The Facility Plans associated with the O&M agreement are the mechanism for the contributing utility to plan its labor resources and the ATC to plan its budget. It includes provisions for corrective or unplanned maintenance. If the unplanned maintenance exceeds the amount anticipated for a given quarter, it may have an impact on the completion of scheduled maintenance tasks. Through the quarterly Facility Plan update process, adjustments can be made to future quarters to balance the labor and financial resources.